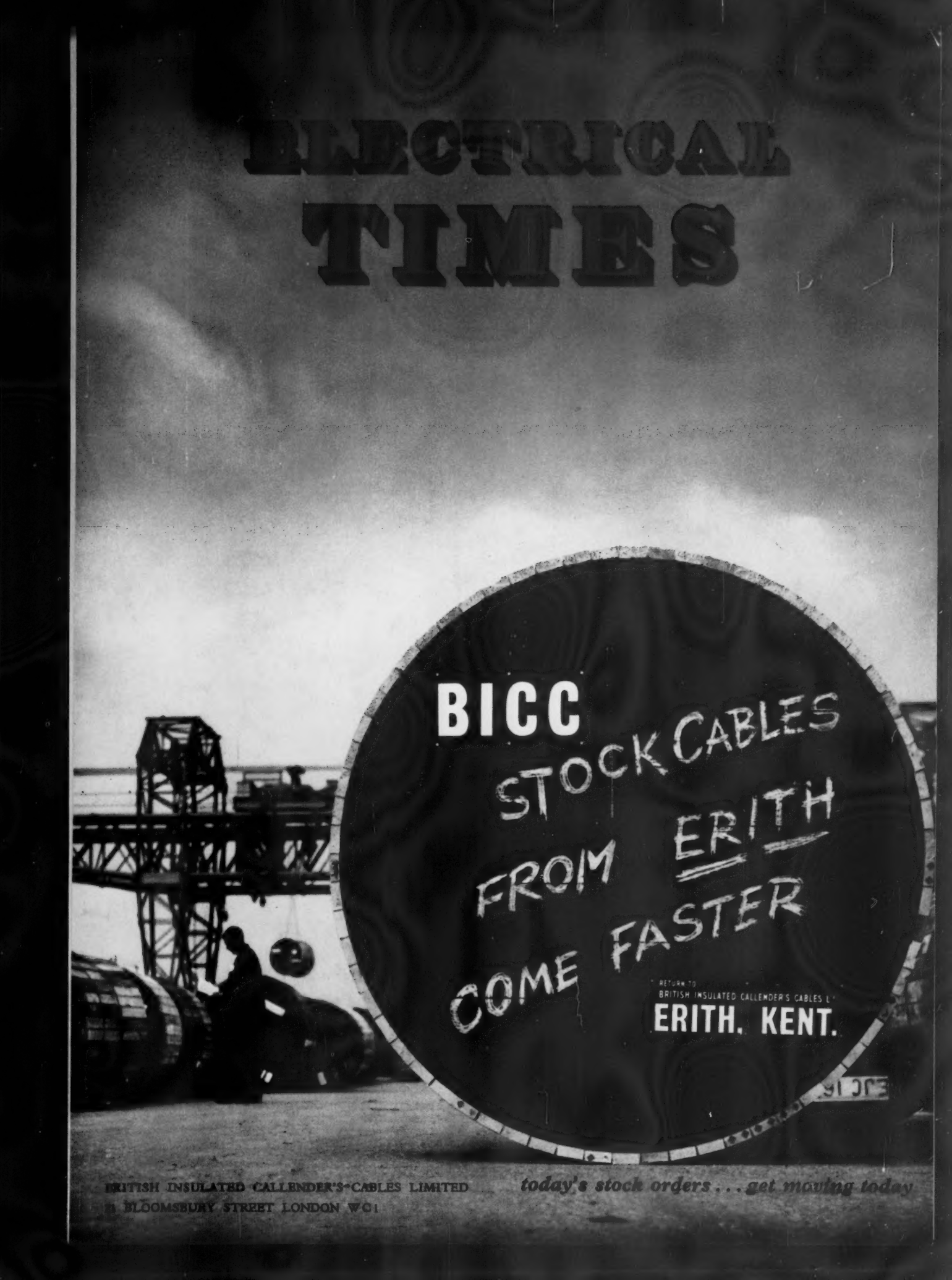
ELECTRICAL TIMES



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Copper faced "Paxolin" is available in three standard grades—
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Please write for our leaflet on copper faced "Paxolin".
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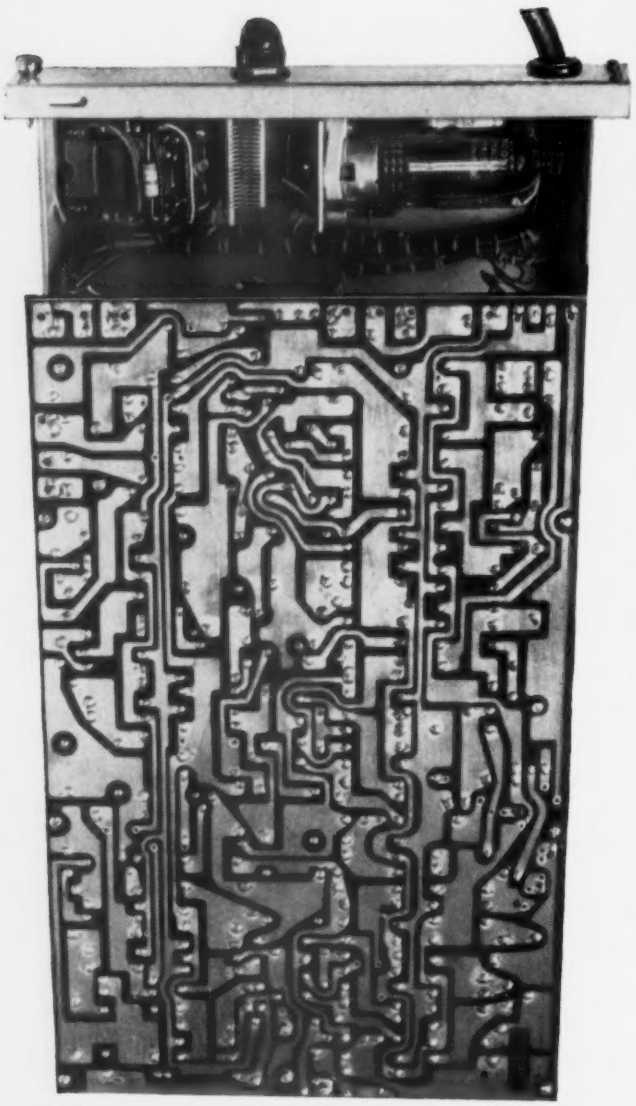

... carrier unit of the MC10 V.H.F. Radio Telephone Terminal. Photograph by courtesy of A.E.I. Telecommunications Division.

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the electrical insulation people

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A

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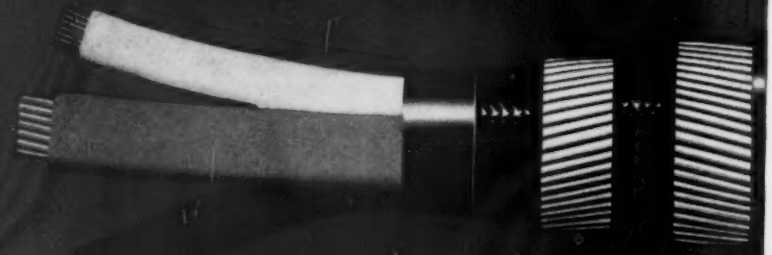
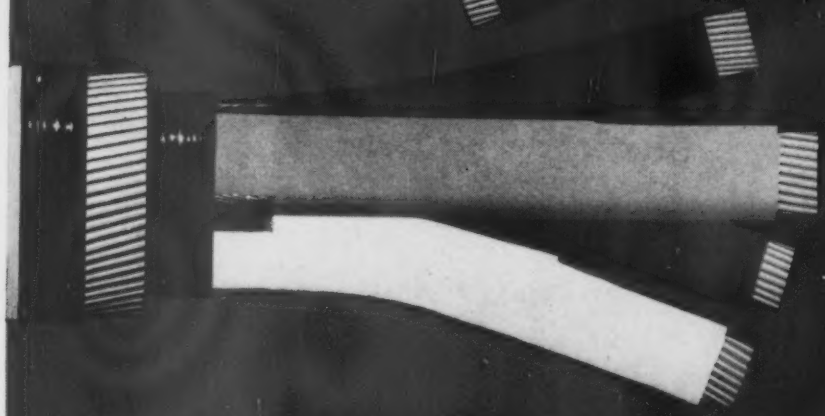
with pre-spiralled shaped conductors

FOR USE IN MINES





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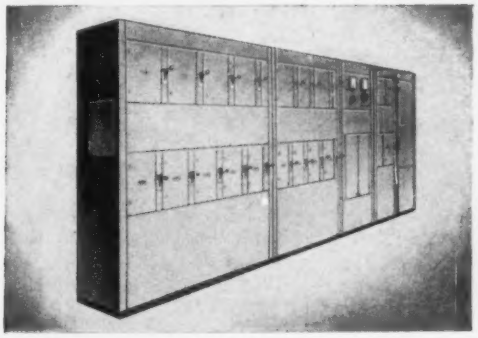

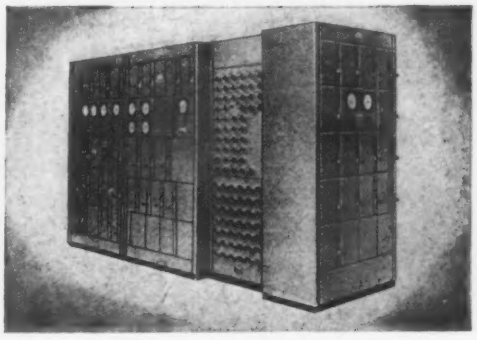

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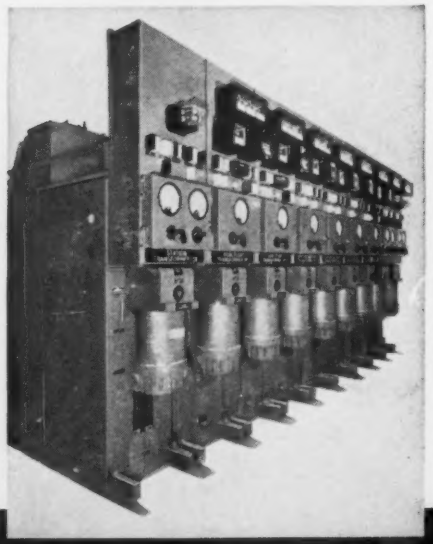
The gear is air-insulated, metal-enclosed and vertically isolated, comprising 2 000 Amp Station Switch Boards and 1 000 Amp Station Boards, Unit Boards, Unit Boiler Boards and Changeover Cubicles.

SOUTH WALES SWITCHGEAR

for Northfleet Power Station



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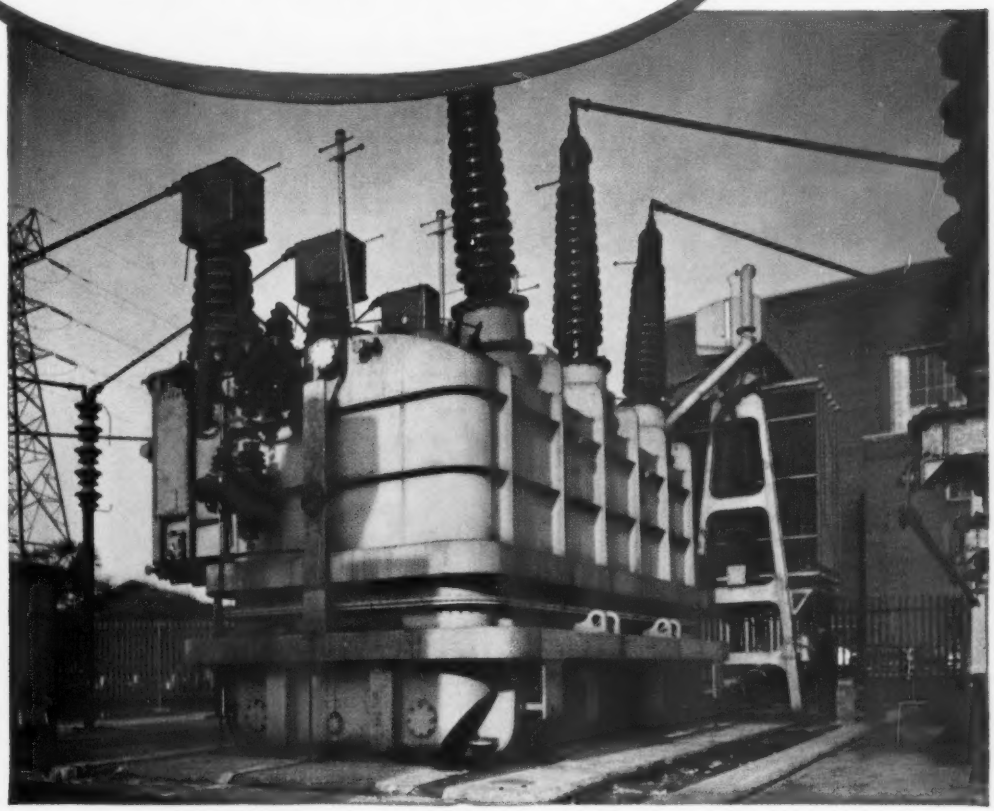

The first 180 MVA, 3 phase, 132/275 kV auto-transformer to be completed for the Central Electricity Generating Board.

Illustration shows the first of two of these transformers at the Skelton Grange Substation of the Yorkshire Division of the C.E.G.B.

The transformers, each fitted with resistor transition on-load tap changers, were manufactured at the AEI Rugby Transformer Works.

For further details write to AEI Transformer Division, Southmoor Road, Wythenshawe, Manchester 23 or your local AEI office.

AEI

Transformer Division
Manchester and Rugby
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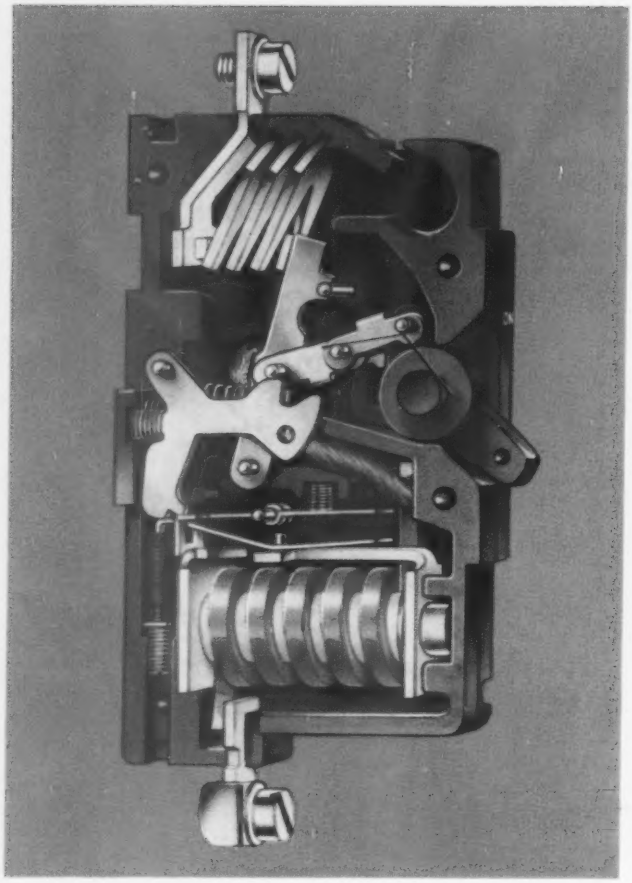

The inside story of

Britain's finest domestic Circuit Breaker

- HARMLESS TRANSIENT OVERLOADS CANNOT CAUSE NUISANCE TRIPPING
- INTERMEDIATE PROTECTION AGAINST HEAVY OVERLOAD OR SHORT-CIRCUIT FAULT CONDITIONS
- CLOSE AND ACCURATE PROTECTION AGAINST SUSTAINED OVERLOADING
- PERFORMANCE UNAFFECTED BY VARIATIONS IN AMBIENT TEMPERATURE
- ALL RATINGS WILL MAINTAIN THEIR ACCURATE TRIPPING CHARACTERISTIC AFTER REPEATEDLY CLEARING OVERLOAD OR SHORT-CIRCUIT FAULTS
- A WIDE RANGE OF SHEET-METAL ENCLOSURES FOR BOTH INDUSTRIAL AND DOMESTIC INSTALLATIONS WILL ALSO BE AVAILABLE

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Here is the first all-insulated consumer's unit to embody circuit-breaker protection.

This unique Crabtree Consumer's Unit brings to the domestic user all the advantages of an entirely new miniature circuit-breaker—the Crabtree Type C-50.

Although designed to give all the advantages of miniature circuit breaker protection at a domestic installation price, the Type C-50 provides an industrial level of protection against overload or short-circuit fault conditions.

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BRITISH DRIVER-HARRIS

We have made a specialised study of the production of alloys used for metal-to-glass and ceramic seals. The essential requirement is to have a seal which remains vacuum-tight under all normal operating conditions. And that of course requires each alloy to have similar expansion properties to the matching glass or ceramic. Each alloy is produced at our Cheadle Heath plant, and is subjected to rigid control and testing, both in the works and in the laboratory.

FOR SOFT GLASSES	FOR HARD GLASSES
Lead Glasses No. 4 Alloy *and* 26% Chromium-Iron	**Boro-Silicate Glasses** Therlo*
Soda Glasses 48% Nickel-Iron	**Ceramic Materials** Therlo*

No. 4 Alloy Used in the radio valve industry for contact pins in moulded glass bases, and also for the sealed-in buttons in cathode ray tubes. It can be used without copper coating with soft glasses of the lead-silicate type.

48% Nickel-Iron The coefficient of expansion of this alloy is approximately equal to that of soft glasses such as soda-lime and lead. It is therefore used over a very wide field; electric lamps and mercury vacuum switches are examples. This alloy has the high susceptibility needed for low wattage relays or pick-ups, and its negligible core loss is useful in high-frequency transformers or relays.

26% Chromium-Iron includes among its applications moulded glass valve bases. It has a high chromium content and thus produces an exceptionally adherent chromium-oxide-rich film for vacuum-tight seals.

Therlo* For hard glasses of the boro-silicate type, an alloy with low expansion properties is essential. Therlo* is designed accordingly. It is used for contact pins in radio valve glass bases, all hard glass applications and certain ceramics.

Other Compositions Most conventional uses of glass-sealing alloys in industry are covered by the four alloys mentioned above. But we welcome inquiries involving more specialised needs where alloys of a different composition may be called for.

Fuller technical information is given in Data Sheet No. 3, a copy of which will be sent to you on request.

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Cheadle Heath, Stockport, Cheshire

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ONLY RAMSET OFFERS ALL THESE PRODUCT FEATURES AND SERVICES

* Complete safety with Flite Chek
* Lifetime guarantee on tools
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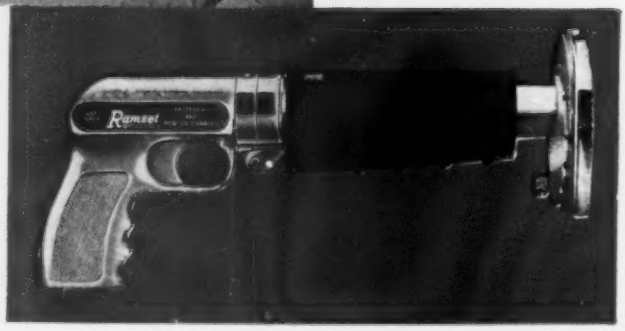
* Same-day service and supply to site
* Free technical advice and operator training scheme
* Full range of fasteners and attachments to tackle every fastening job.

Ramset products are obtainable only from the Manufacturers or through their appointed dealers.



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one of Europe's largest transformers

Ferranti giant transformer for Britain's super grid

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SWITCHGEAR

EXTENSION TO RANGE

Brush type HF 11 High-Voltage Switch-Fuse Units for indoor or outdoor service are an economical method of controlling and protecting power transformers. Extensive technical development of powder-filled fuse-links for use in the air-insulated fuse chamber of Brush units has resulted in the availability of much higher current rating fuse-links enabling these switch-fuse units to be used for the control of 1500 kVA 11 kV transformers.

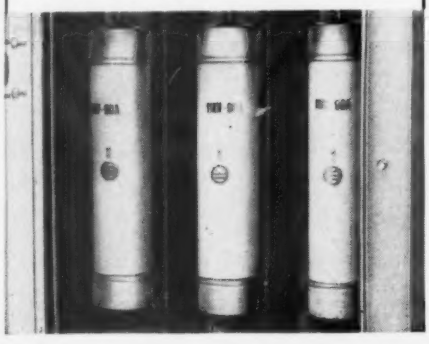
BRUSH

BRUSH ELECTRICAL ENGINEERING CO LTD

LOUGHBOROUGH ENGLAND

A Member of the Hawker Siddeley Group

Type HF 11 Switch-Fuse unit, with chamber door open, showing 90 ampere 11 kV fuse-links.



S7

NEWS SHEET

Coal for power stations up 5s 1d/ton in round of NCB increases that puts gas coal up 6s 8d/ton, and general industrial coal up 7s 1d/ton. Cost to supply industry in full year between £11m. and £12m. NCB claim production costs reduced, but capital expenditure and higher wages point need to earn £60m. more a year. (425, 454)

Revised standard for medium voltage o.c.b's. changes nominal voltages and standard current ratings; introduces ratings for FLP gear and tightens type testing requirements. (426, 446)

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Water gauges not required on factory electrode and immersion boilers, under Factories Act exemption granted by Chief Inspector of Factories. (457)

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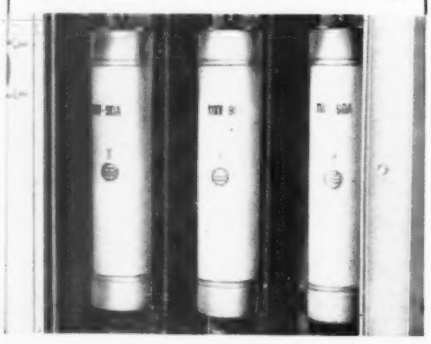

37

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NEWS SHEET

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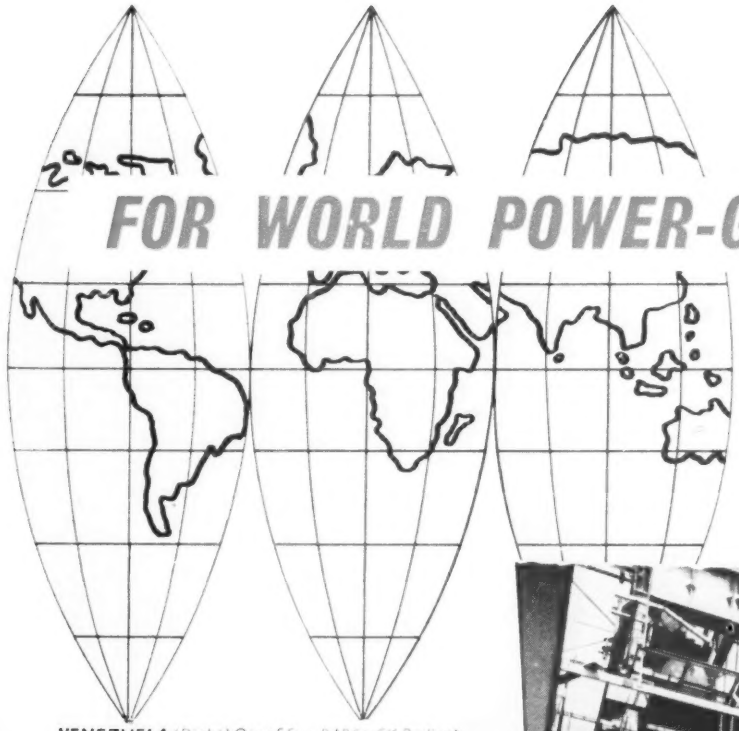
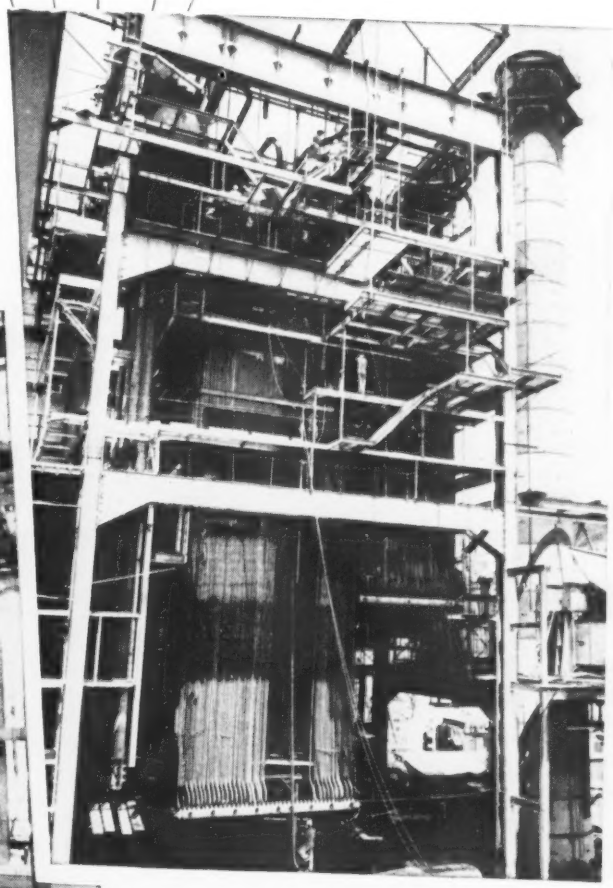
OVERSEAS—Peace River Power Co. making next application . . . Pretoria orders more station plant . . . Pakistan proposes 100 MW h.e. scheme for Sangu River . . . Site investigations for 30 MW steam station for Korea . . . Wangi (NSW) and Liapootah (Tasmania) stations at full capacity . . . Japan signs agreement for US 12½ MW nuclear scheme . . . 7,414 units is average annual domestic consumption in Hutt Valley (NZ) . . . Power control centre to be established at Lyallpur (W. Pakistan). (440, 441)



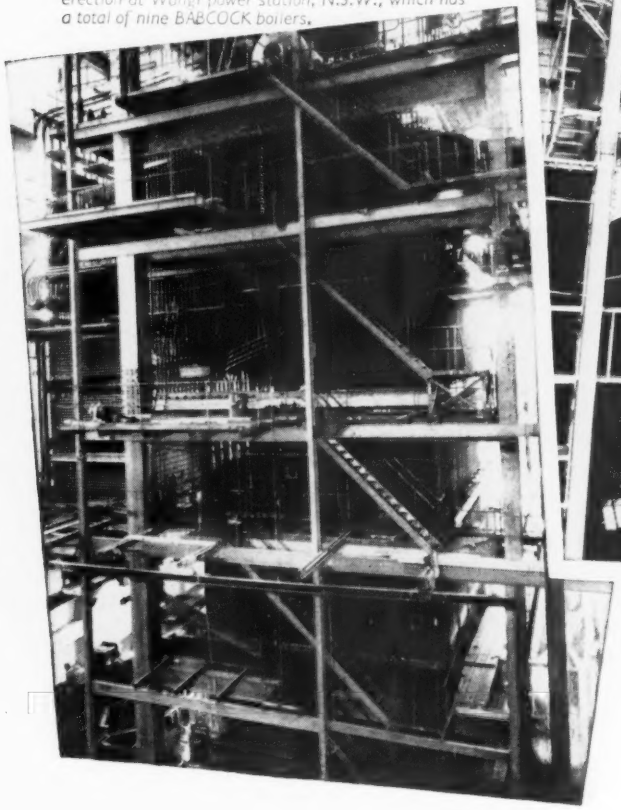
FOR WORLD POWER-GENERATION

STEAM is, by far, the world's most important medium for electrical-power generation and a very high proportion of the world's power stations is equipped with BABCOCK steam-raising plant.



VENEZUELA (Right) *One of four BABCOCK Radiant boilers, natural-gas and oil fired, each rated at 550,000 lb./hr.; during erection for La Electricidad de Caracas. (Consulting Engineers: Sofina)*

AUSTRALIA (Below) *One of three BABCOCK Radiant boilers, each rated at 550,000 lb./hr.; during erection at Wangi power station, N.S.W., which has a total of nine BABCOCK boilers.*



BABCOCK

STEAM-RAISING PLANT

BABCOCK & WILCOX LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.1.

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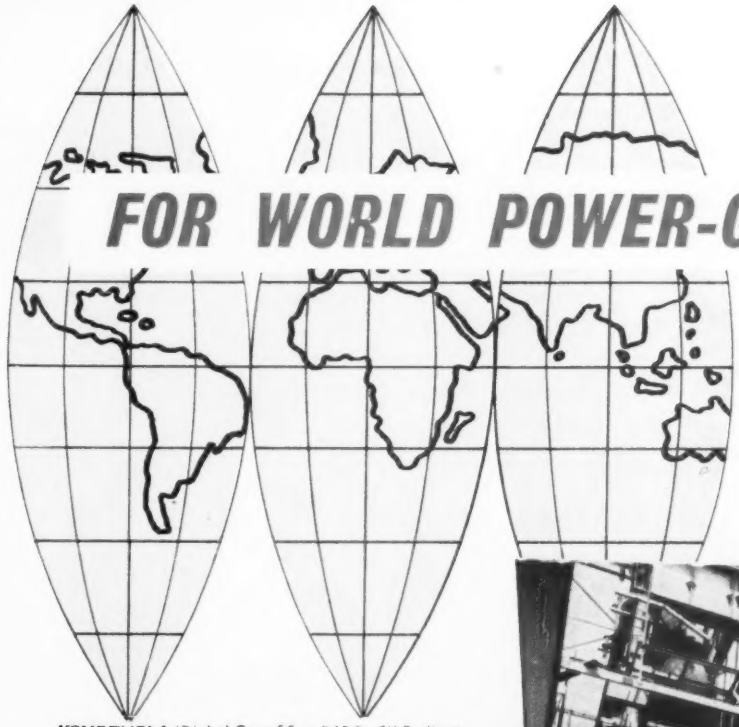
Cut in off-peak tariffs forecast for S. Scotland EB, despite increased coal price. Operative from 1 December. (454)

BUSINESS—Crompton Parkinson enter domestic heating market (454) . . . Further Spencer steelworks contracts for AEI (£500,000 cable), GEC (£362,000 m.a. rectifier and pickle line plant) and Film Cooling Towers (456) . . . Hemel Hempstead factory for Honeywell Controls (456) . . . Northern Aluminium name changed to Alcan Industries (454) . . . Increased six months' output value by AEI but net profit down . . . Poor results by Kenwood Manfg. and no dividend . . . £122,000 loss by Vactric whose cash difficulty is causing anxiety . . . Dimplex nearly double profit and propose one-for-five free issue . . . A. C. Cossor make loss, with profit of Sterling Cable subsidiary down to £28,500 . . . L. Sterne's estimate lower current profits, but raising £1m. capital in one-for-five issue. (460)

OVERSEAS—Peace River Power Co. making next application . . . Pretoria orders more station plant . . . Pakistan proposes 100 MW h.e. scheme for Sangu River . . . Site investigations for 30 MW steam station for Korea . . . Wangi (NSW) and Liapootah (Tasmania) stations at full capacity . . . Japan signs agreement for US 12½ MW nuclear scheme . . . 7,414 units is average annual domestic consumption in Hutt Valley (NZ) . . . Power control centre to be established at Lyallpur (W. Pakistan). (440, 441)



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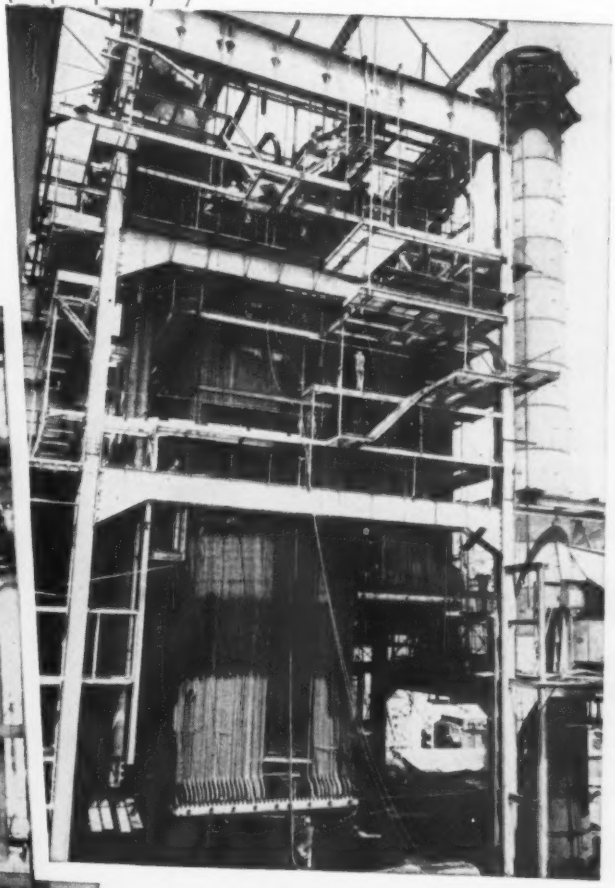
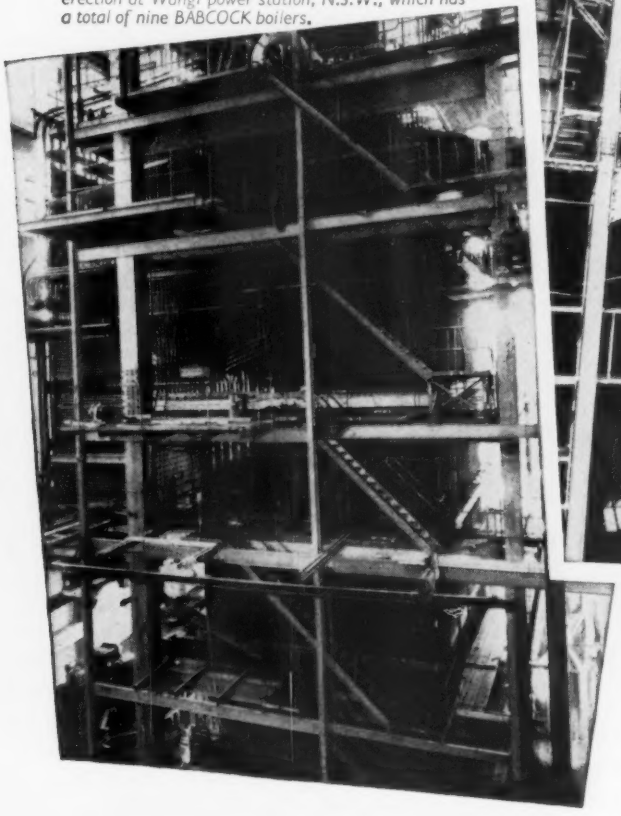
STEAM is, by far, the world's most important medium for electrical-power generation and a very high proportion of the world's power stations is equipped with BABCOCK steam-raising plant.



VENEZUELA (Right) *One of four BABCOCK Radiant boilers, natural-gas and oil fired, each rated at 550,000 lb./hr.; during erection for La Electricidad de Caracas. (Consulting Engineers: Sofina)*

AUSTRALIA (Below) *One of three BABCOCK Radiant boilers, each rated at 550,000 lb./hr.; during erection at Wangi power station, N.S.W., which has a total of nine BABCOCK boilers.*



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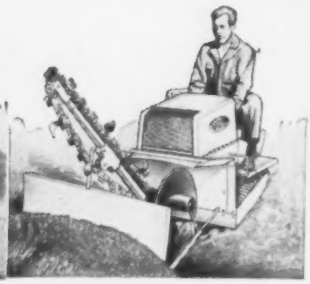

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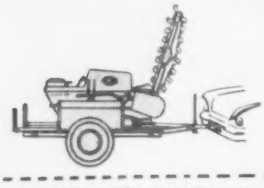

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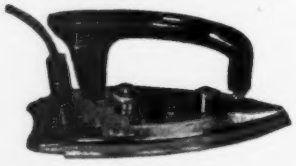

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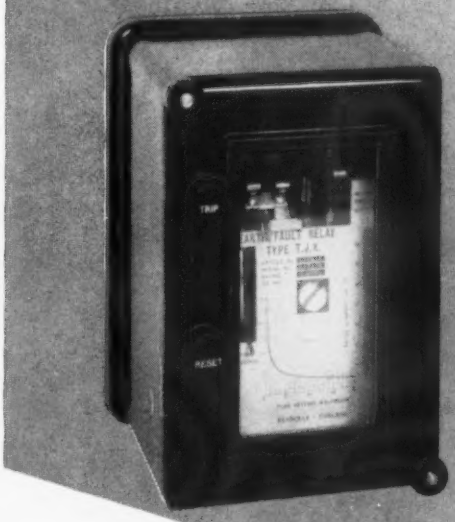
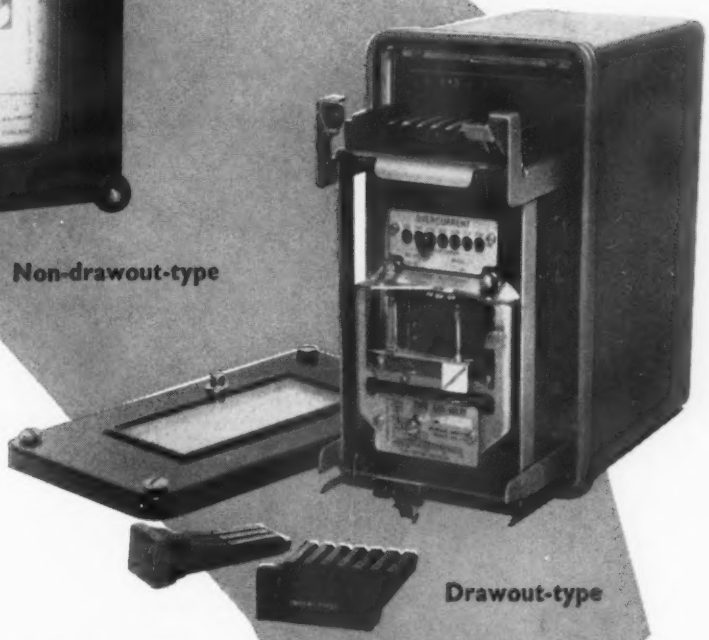


Non-drawout-type



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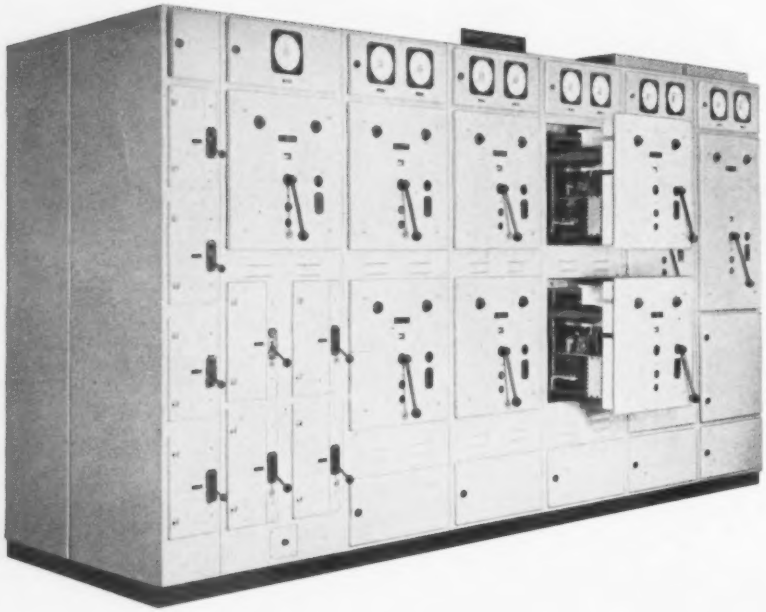

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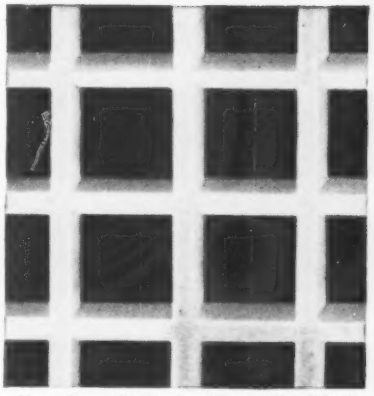
Beetle D.M.C. combines heat resistance with strength, dimensional stability and excellent insulation properties. The development of a special type for a single application typifies the extent of B.I.P. services in relation to individual problems and requirements.



Heat resistance, dimensional stability, strength and electrical insulation properties are among the features making D.M.C. the ideal material for this grille. Moulding by Crystalate (Mouldings) Ltd., Tonbridge, Kent.

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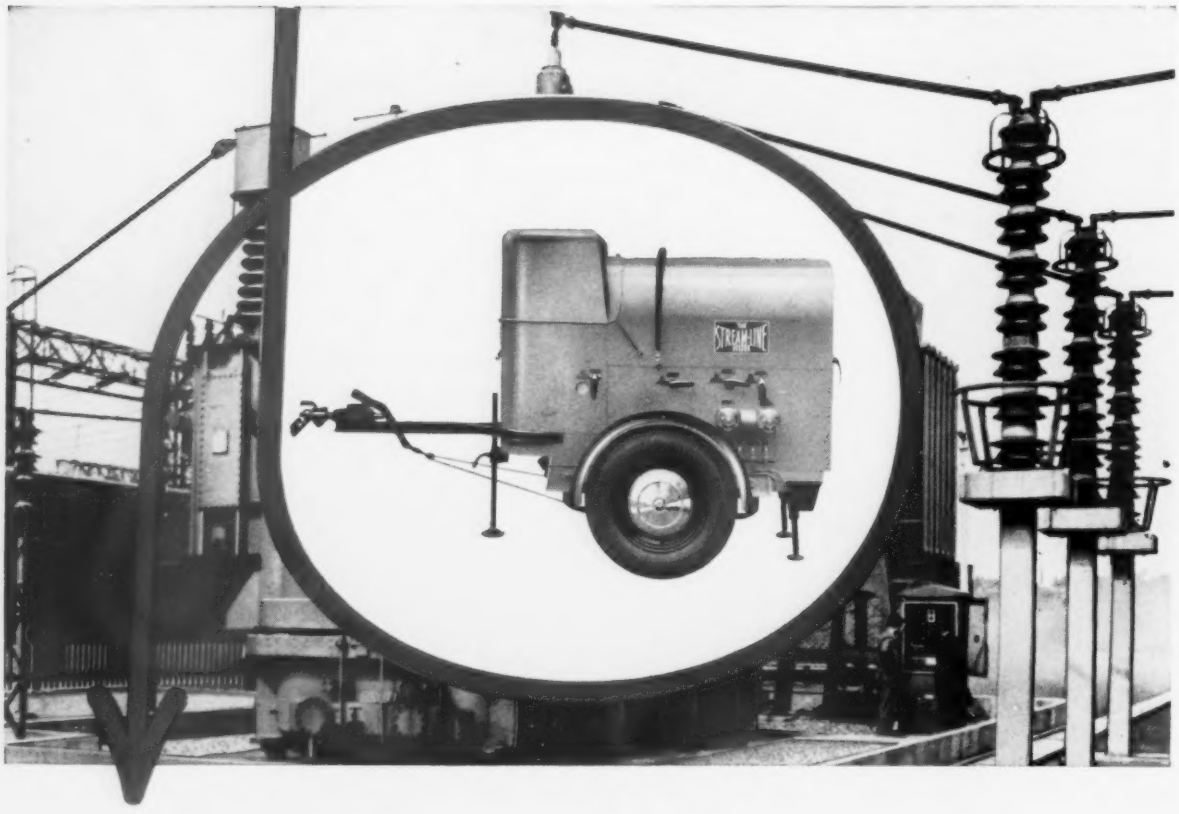
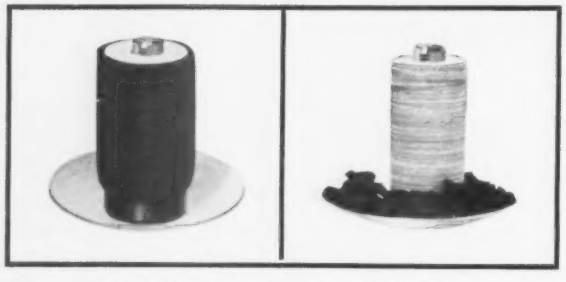


Loop in a Stream-Line filter



These illustrations show the Stream-Line filtering element built up of special paper discs under end pressure. Oil passes through the infinitesimal interstices between the discs leaving solid impurities at the paper edges. Instantaneous cleaning is carried out by a reverse flow of compressed air.

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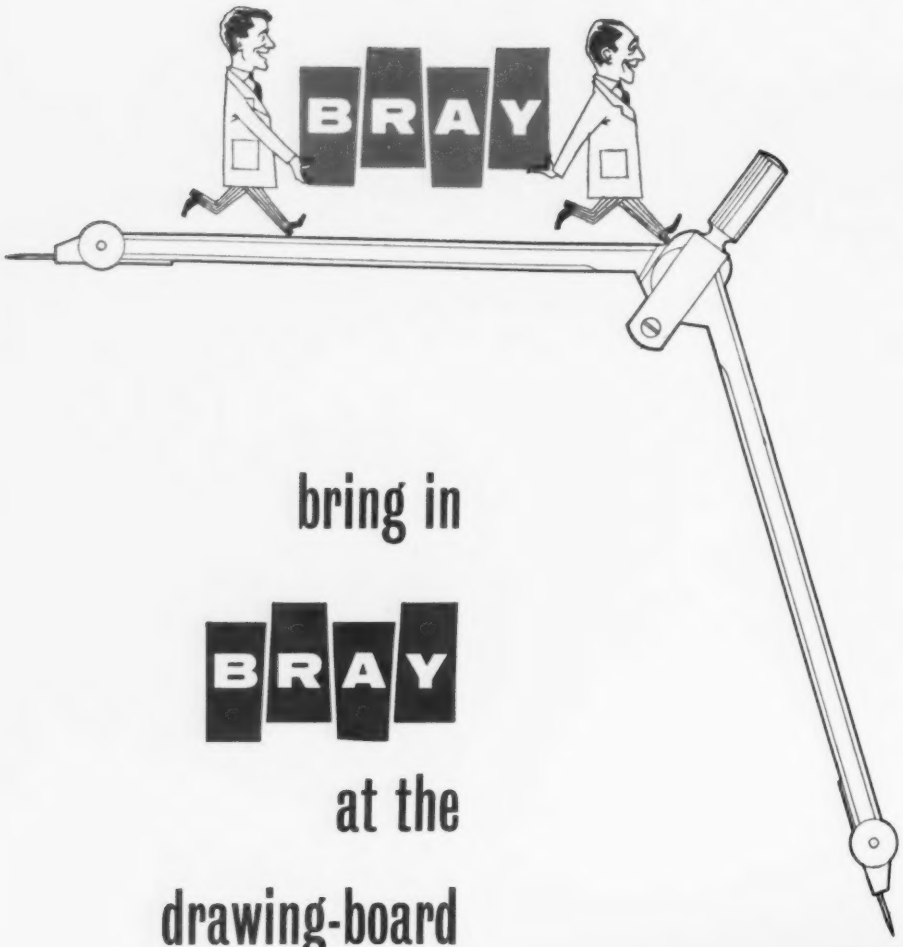

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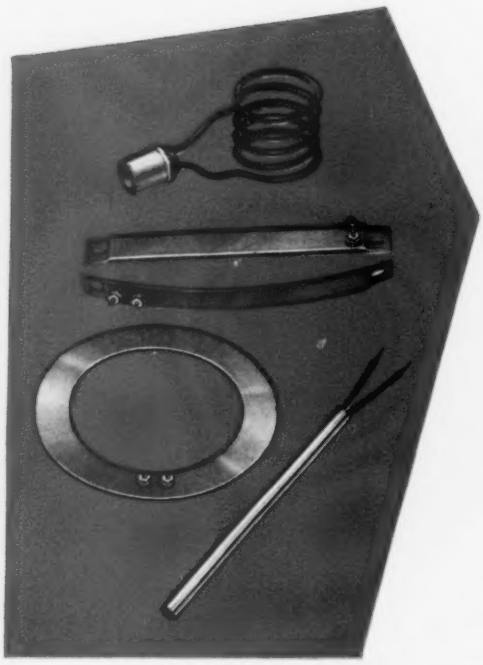

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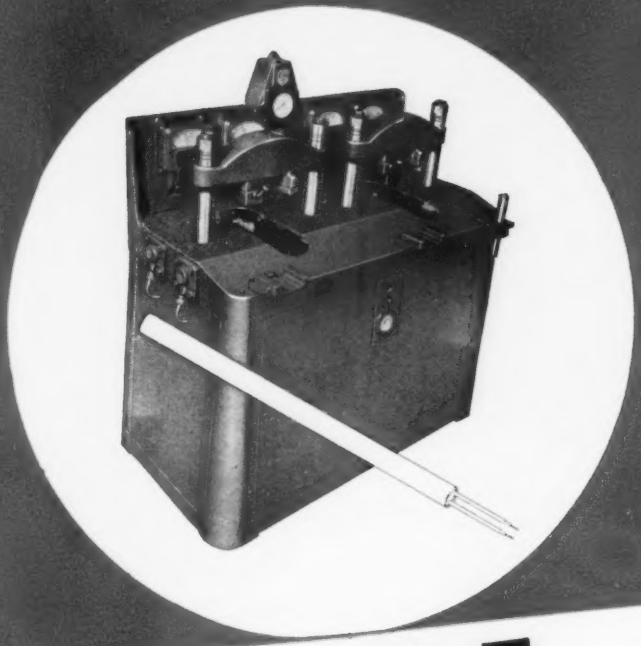

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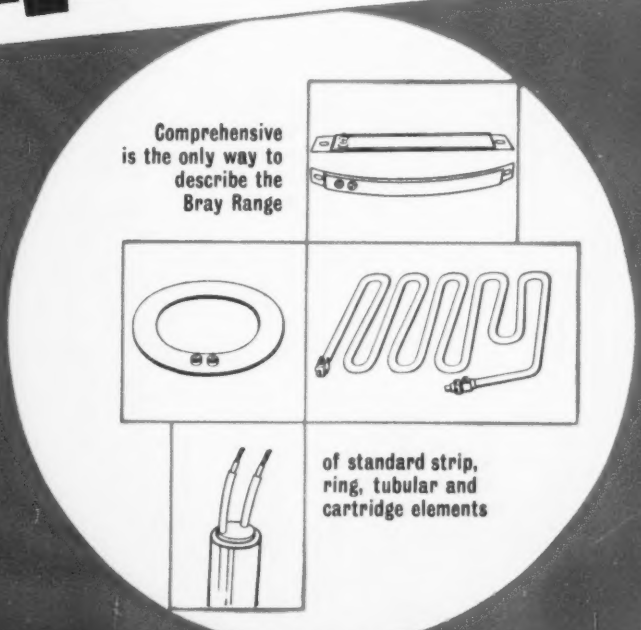

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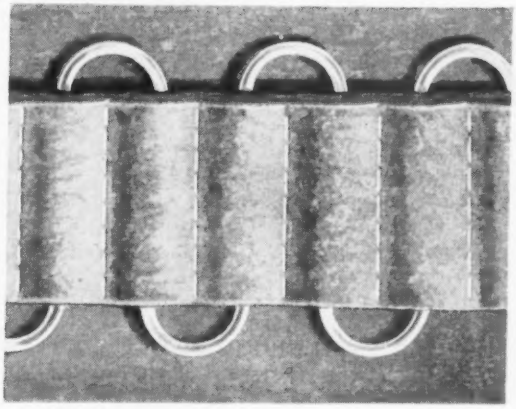

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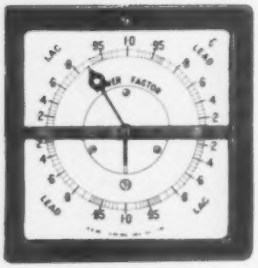

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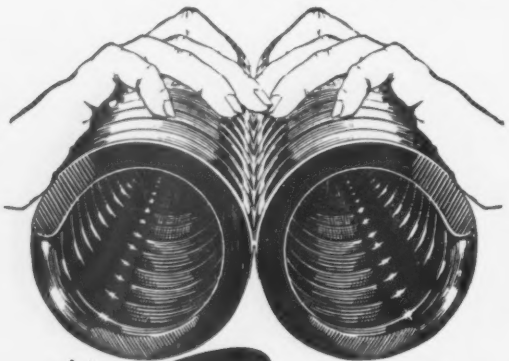

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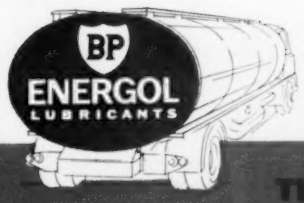

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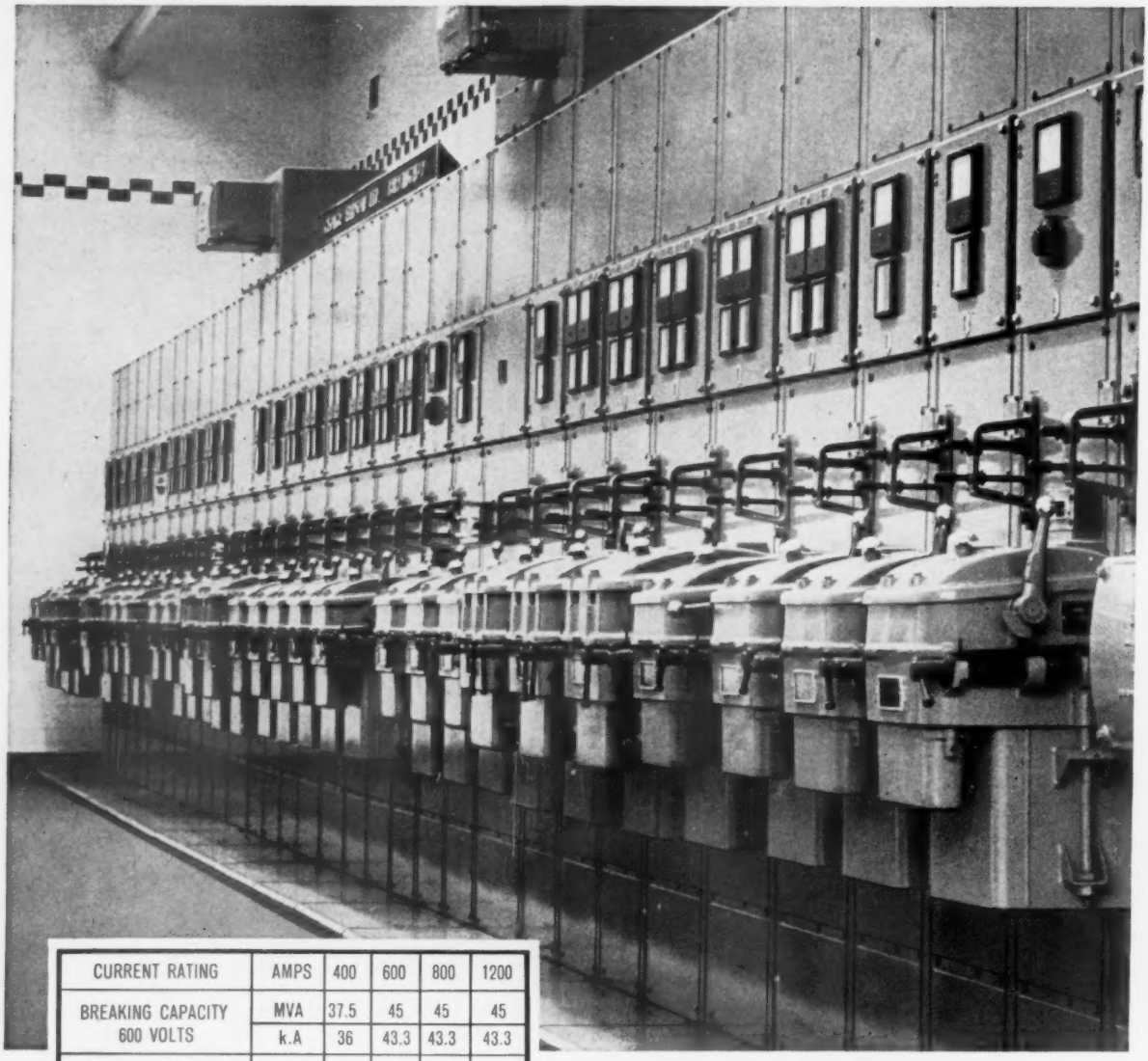

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THURSDAY 22 SEPTEMBER, 1960
Registered as a Newspaper Volume 138 No. 12

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Dans ce numéro

Connection de Câbles Simplifiée 427
On peut connecter par des méthodes mécaniques les câbles isolés au papier, à trois conducteurs et munis d'une gaine en aluminium, tenant lieu de conducteur neutre concentrique. On pratique une fente hélicoïdale dans la gaine pour éviter d'interrompre sa continuité en tant que conducteur. On connecte ensuite une ligne de branchement sans couper de conducteur porteur de courant, en fixant les connections mécaniques sur les conducteurs du câble du secteur.

Surtensions sur Lignes à Haute Tension 433
Des surtensions considérables dues à des phénomènes de réamorçage à la suite d'opérations de commutation peuvent se produire sur les lignes à haute tension. Dans un article étudiant l'importance de telles surtensions, l'auteur écrit en conclusion que l'effet couronne est important lorsqu'il se produit plus d'un réamorçage dans le cas de lignes courtes, et même un seul réamorçage dans le cas de lignes longues. Un surtension peut aussi être causée par résonance lorsque le secondaire du transformateur de réception s'ouvre sur une longue ligne de transmission.

Réacteurs à Haute Température ... ... 430 & 445
Les réalisateurs de réacteurs nucléaires, tant aux Etats-Unis qu'en Grand-Bretagne, essaient de produire des températures de sortie plus élevées pour obtenir un rendement thermique meilleur sur les turbo-alternateurs associés.

Eclairage Public 437
Des communications faites à la conférence de l'association des ingénieurs éclairagistes étudient l'effet qu'ont les surfaces des routes sur les conditions de visibilité pour les conducteurs; ainsi que par ailleurs, les tendances actuelles dans la technique de l'éclairage.

In dieser Nummer

Vereinfachte Kabelverbindung 427
Papierisolierte Kabel, die drei Seelen und eine als konzentrischen Nulleiter dienende Aluminiumhülle aufweisen, lassen sich auf mechanischem Wege verbinden. Zunächst wird die Aluminiumhülle schraubenlinienförmig so aufgeschlitzt, dass die Isolierung blossgelegt wird ohne der Wirksamkeit der Hülle als durchgehenden Leiter abbruch zu tun. Sodann wird ein Abzeigkabel mittels Klemmvorrichtungen angeschlossen, ohne Durchtrennung eines einzigen stromführenden Leiters.

Ueberlastungserscheinungen an Hochspannungsleitungen 433
Beträchtliche Ueberspannungen können als Folge der Einschwingung nach Schaltvorgängen an Hochspannungsleitungen auftreten. In einer Abhandlung über derartige Ueberspannungen gelangt der Verfasser zur Schlussfolgerung, dass die Wirkung der Korona eine wichtige Rolle spielt bei mehrmaliger Einschwingung auf kurzen Strecken und sogar bei einmaliger Einschwingung auf langen Strecken. Eine Ueberbeanspruchung kann auch durch Resonanz entstehen beim Oeffnen der Sekundärseite des aufnehmenden Transformators an einer langen Leitungsstrecke.

Reaktoren mit hoher Betriebstemperatur ... 430 & 445
Konstrukteure nuklearer Reaktoren sowohl in den Vereinigten Staaten wie in Grossbritannien sind danach bestrebt, Reaktoren mit höherer Ausgangstemperatur zu bauen, damit der Wärmewirkungsgrad der angeschlosssenen Turbogeneratorsätze erhöht werden kann.

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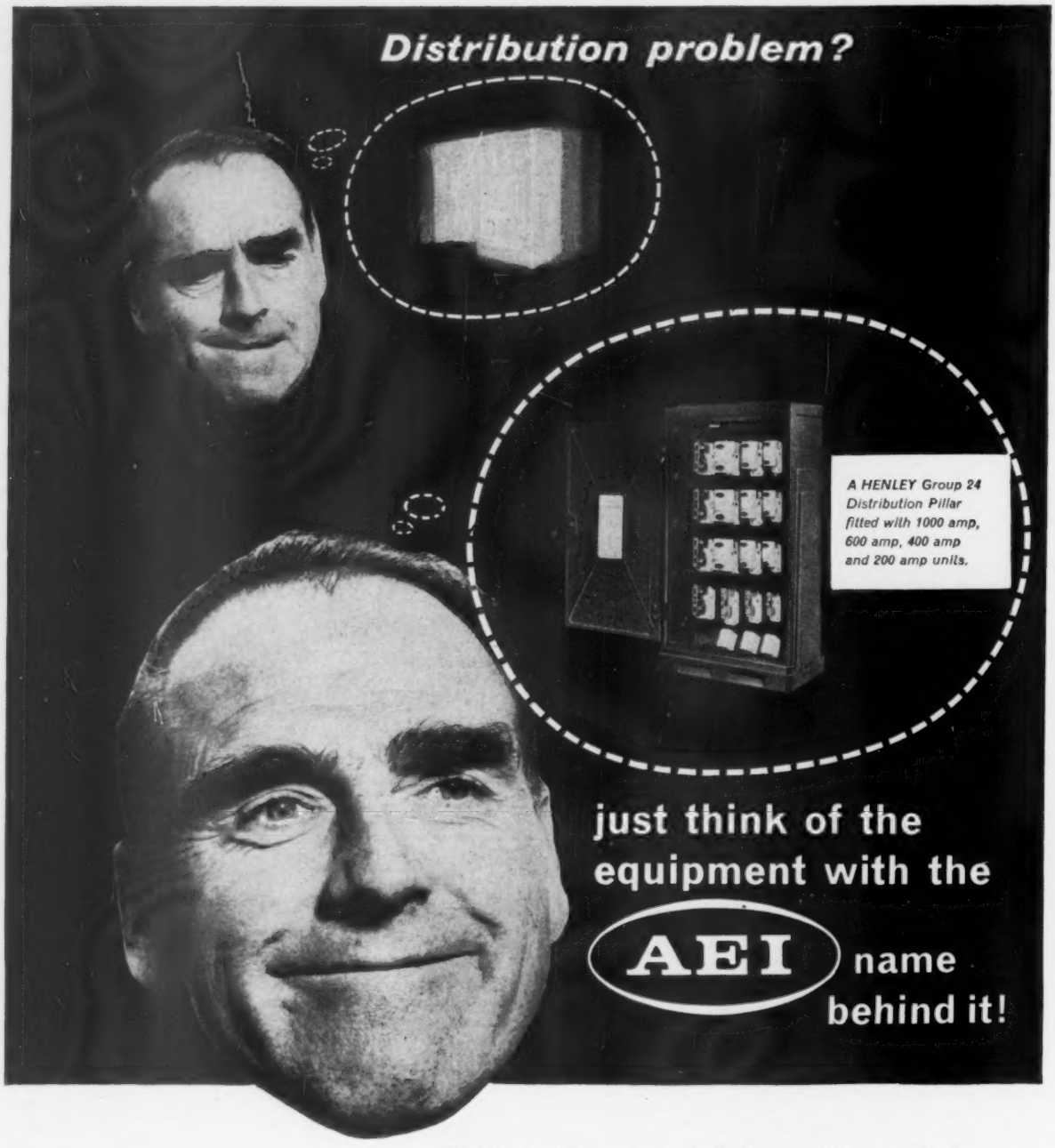
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Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Joint Editor:
K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor:
T. W. WRIGHT

Comment

COSTS, COAL AND LOAD GROWTH

On any increase in the price of coal, supply engineers instinctively reach for their slide rules to work out its influence on costs. This is a natural reaction in an industry so traditionally identified with coal as a raw material, but in the complex structure of supply today there are other factors of at least as great significance in the make-up of the debit side. Although the new 5s 1d/ton increase to electricity is less than for other coal classes, no one pretends that this is a commercially realistic figure. After the short respite of the last two years, we are back once again to the average 5% to 6% increase per annum since vesting day, but what it will mean in unit costs is not easy to calculate until the 1959-60 figures, which are due in a week's time, become available. It looks as though something of the order of an additional £12 million will have to be paid over the next 12 months, allowing for an improvement in thermal efficiency, and half of this amount will automatically be passed on to industrial consumers through the tariff fuel cost adjustments. More significant in next year's Electricity Council's accounts will be the recent round of wage increases throughout the industry. This will add another £11 million to labour costs in a full year and there are no wage rate clauses in tariffs to pass it on automatically. Neither must there be forgotten the industry's commitments on self-financing of its capital needs, which has to be stepped up from the 46% of 1958-59. If the average figure of 48% self-financing over the seven years to 1965 is to be achieved, then the amount to be found in coming years is likely to be more than the higher cost of coal to the industry. On the credit side, electricity sales are still soaring. Basic growth in output for the past 12 months has been averaging well over 10% and, with the higher revenue-earning domestic units outstripping the rise in industrial units sold, there would seem a reasonable prospect of the industry being capable of carrying these costs without tariff changes.

STREAMLINED E.R.A.

Plans of the Electrical Research Association to bring a new urgency into the conduct of its affairs will take an important step forward in coming months as a new divisional committee structure for the management of research is brought into operation. Twenty committees reporting to the ERA council are being cut to six, which between them will recommend broadly the work the Association should undertake. On the council's judgment of relative research needs, the committees will be allocated funds which they can split between competing research projects as they judge best. Specific researches will be the concern of advisory committees,

watching progress and formally reporting on it rather than directing research activities. One of the results that may be hoped to follow the new organisation is speedier completion of particular research projects and a flexibility of decision in swinging increased effort into an investigation when it seems that a decisive point has been approached. Again, the fewer committees operating directly under the council should have the always-desirable effect of attracting a higher standard of membership, with the corollary of more immediate decision-taking and less need for reference upwards to secure ratification, especially where financial commitments are involved. Demarcation disputes must, of course, be expected with the truncated structure, but they should not be difficult to resolve. What may require more careful watching is that deserving researches are not left to languish because they do not fall neatly into any one of the six sections, whose titles give an apparently misleading suggestion of concern with the electricity supply industry.

BASIC FACTS FOR REACTOR DESIGN

Winfrith Heath, the UK Atomic Energy Authority's extension of Harwell as a research centre, has occupied the headlines mainly as the home of the co-operative Dragon venture, in which 12 European countries are working on a new form of reactor. Yet Dragon is not fully typical of the work of this fast-expanding establishment. Its essential purpose is to feed power reactor designers with the basic facts on which they can proceed to prototype design and later refine the details of full-size nuclear power station reactors. Its growing range of equipment and experimental installations provides a sharp reminder that there is a great deal still to learn about the way nuclear reactors operate. While the successor to the Magnox type of reactor for the British supply authorities is being discussed, there is still no operating example of a full-power reactor on the Magnox principle. This point is hammered home by the activity in another co-operative project at Winfrith Heath, BICEP, in which the British nuclear consortia and the UKAEA are working together to investigate the details of neutron behaviour in graphite-moderated reactors and to elucidate such questions of operating importance as the way in which build-up of plutonium in Magnox reactors will affect their operational performance. Even in this project, however, there is an eye to the developments of the more distant future, and elsewhere at the establishment there is much effort going into providing the broad answers to questions that arise from outline sketches for possible reactor systems for the years ahead.

MORE JOINT SIMPLICITY

Much attention has been given recently to taking the art out of medium voltage cable jointing. Crimped connections have been brought in to replace soldering and now the further simplification of direct bolting is being advanced as a straightforward way of dealing with the service jointing problem. German practice seems to accept this technique, though many British engineers will initially view it with suspicion bred from experience with bolted connections that have failed to maintain the desired continuity in more accessible applications than a buried cable joint. On the other hand, there is economy in the method and tests indicate that it should be satisfactory in service given reasonable care in making the joint. One of the incidental advantages is the suitability of the technique for use with distributors in which the sheath is used as a concentric neutral. Once the necessary concomitant of multiple earthing of the neutral has been accepted, three-core and neutral-connected-sheath cables have a well-demonstrated economy, but making the service joints does become something of a problem. A technique suitable for use with plastics-insulated and sheathed cables was described in our pages in March. In discussing the bolted connection, the emphasis is on paper-insulated cables. Whatever the outcome of all this work, the questioning attention now being given to this small but so repetitive operation in supply engineering must be generally welcomed.

NEW RULES FOR INDUSTRIAL O.C.B's.

Probably the majority of oil circuit-breakers for medium voltage use are sold to manufacturing industry, so the revised British Standard for such breakers published last week should attract the attention of works electrical engineers. They will find much change of wording from the previous edition, one of the last-surviving of the war-time yellow emergency standards; but not a great deal of alteration in basic requirements, apart from a change in nominal voltage ratings. Where the revision has been most thorough and where its effect will, in fact, be felt, is in the tighter specification of just what is acceptable performance in type tests at testing stations. This is a question which has received the closest attention in recent years, with the object of securing uniformity in interpretation of the requirements of circuit-breaker standards. Unless there is close control on such matters, tests at separate stations come to have different meanings. ASTA has, of course, given consideration to such questions from its earliest activities. Writing the requirements into British Standards helps extend that uniformity to Continental testing stations, to which British manufacturers often have resort. This question apart, circuit-breaker users will find one extension of the previous standard to their liking: inclusion of standard ranges specifically for flame-proof-enclosed switchgear. Such gear has found much-widened application in industry over the last decade, and provision for it in a standard not having its origins in mining requirements is a welcome step forward.

Meteor

This week's quick summary of electrical news faces advertisement page 12

Simplified service jointing for paper-insulated cables

by F. G. McDonald,* M.I.E.E.

THERE is great interest all over the world in less expensive cables and in simpler methods of jointing. Most of the interest has been shown in plastics-insulated cables. Simple methods for jointing and terminating plastics cables for industrial use have been developed by a number of different manufacturers, and these methods are making plastics cables appear attractive as mains cables. A number of trial installations of plastics underground mains cables now exist in this country.

A new approach is being brought to the design of joints for plastics cables. The idea is gaining ground that a joint can be small, cheap and quick to make, and that it should be made without blow-lamps or special tools, preferably with only a spanner and a screwdriver. It is interesting to think that while this has been going on, the conception of what a joint should look like on a paper-insulated, metal-sheathed mains cable has remained unchanged. Most jointers are still using methods that were being used 40 years ago.

Some of the more flimsy devices being used on plastics cables might not be generally acceptable for heavy-duty mains, but this should not mean that users of paper cables should disregard all plastics techniques; they could make use of some of the ideas.

There is a notable contrast between a termination for a paper-insulated cable which is offered by a manufacturer whose main business is glands for plastics or rubber wiring cables, and the heavy cast iron terminating box with wiped or cone grip gland which is offered by a cable maker. More notable still is the contrast between a service tee on a plastics cable and a typical service tee on a p.i.l.c. cable. Most of the proposals for service tees on plastics cables provide for the actual connections being made mechanically—by bolted clamps or compression ferrules. There is an evident desire to get away from soldering.

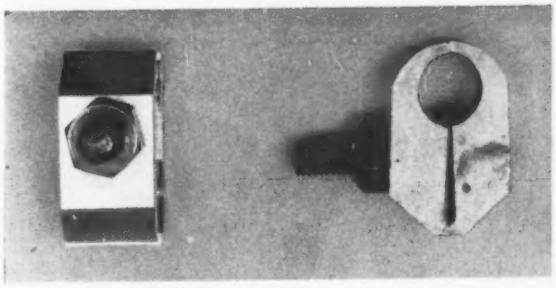


Fig. 1. German "claw-type" connector for service connection to round or sector-shaped conductors (DIN 47671)

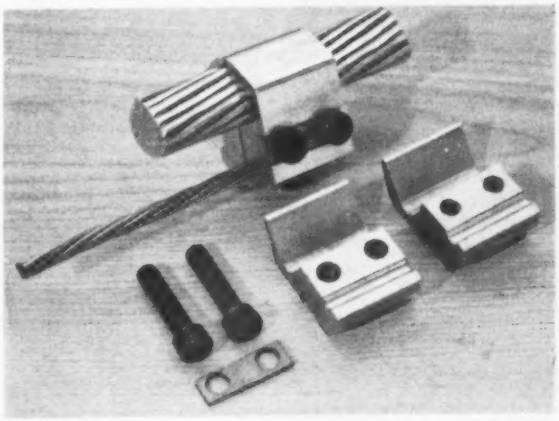


Fig. 2. Prototype "claw-type" connector developed in England for 0·0225 sq in. (copper) service connections to 0·3 sq in. conductor of four-core aluminium cable. The clamp body is of D5ISWP alloy, made as an extrusion

Clamps for Joints

With paper-insulated cables, soldering of tee connections is almost universal. Soldering has great advantages but it is not absolutely necessary. In Germany, many of the most important supply authorities use bolted clamps for making service connections. Fig. 1 shows the type of clamp most frequently used. These connectors are standardised. Five sizes cover copper cables between 35 and 120 sq mm (0·06 to 0·2 sq in.), another seven sizes cover aluminium cables up to 185 sq mm (0·3 sq in.). The service cable is terminated in a lug which is clamped under the nut of the connector.

In Fig. 2 is shown an early prototype of a parallel-groove clamp now being tried out in this country. This particular connector is designed to take a 0·0225 sq in. (copper) service from a 0·3 sq in. aluminium conductor in a four-core cable. The profile of the grooves in the clamp is that of the shaped conductor. These prototypes have been on load cycle test for several months and are now being short-circuit tested. Results to date give promise of satisfactory performance under the most arduous service conditions.

Plumbed sleeves on lead-sheathed cables can be dispensed with if cast iron cable-grip boxes are used—a common practice in this country.

There is, therefore, nothing new or experimental about a solderless service joint; such a joint, rather, is well-tried.

If it is interesting to think that changes in jointing methods are concerning only plastics cables, it is disturbing to think of one possible result: that plastics cables may on occasion be taking over from paper, not because they are better or cheaper, but simply because more attention is being paid to methods for jointing them.

* Mr McDonald is with Alcan (UK) Ltd.

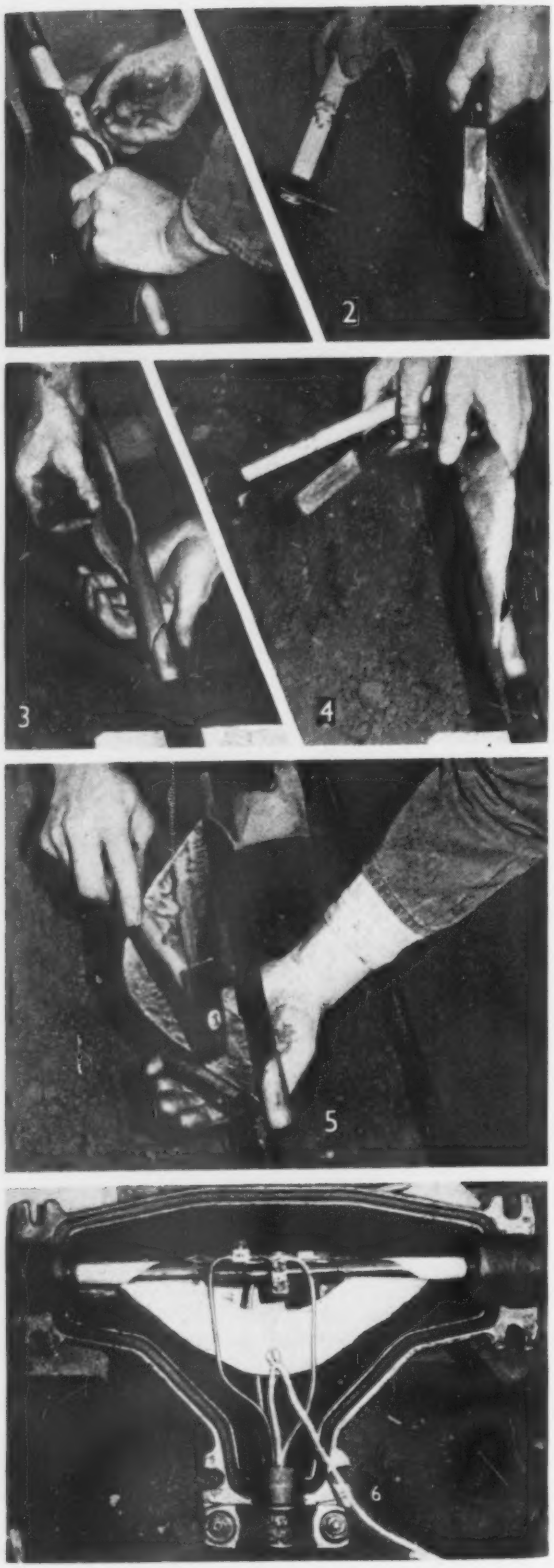


Fig. 3. Service connection made using mechanical connector (Photos courtesy of Kabelwerke Rheydt GMBH, Germany)

1, Template is wrapped round the clean aluminium sheath and the cutting line marked. 2, Sheath is cut along marked line; it is cut through only in the centre of the joint. 3, The cut sheath is peeled back. 4, Peeling back continues. 5, Peeling back complete, the sheath is then hammered flat. 6, Current-carrying connections are made using bolted clamps

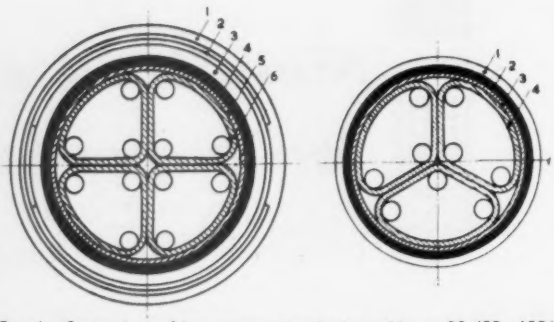


Fig. 4. Comparison of low-voltage distribution cables to BS 480 : 1954

Left, four-core lead-sheathed and armoured cable. Overall diameter 2·42 in. Conductors, 4 by 0·3 sq in. aluminium. Diameter over sheath, 1·88 in. Overall cross-section 4·6 sq in. 1, serving 0·100 in.; 2, armour, 0·070 in.; 3, bedding, 0·100 in.; 4, lead sheath, 0·090 in.; 5, belt insulation, 0·020 in.; 6, conductor insulation, 0·035 in.

Right, three-core cable with aluminium sheath as concentric neutral. Overall diameter, 1·81 in. Conductors, 3 by 0·3 sq in. aluminium. Neutral conductor, 0·385 sq in. Diameter over sheath, 1·61 in. Overall cross-section 2·58 sq in. 1, p.v.c. oversheath, 0·100 in.; 2, aluminium sheath, 0·080 in.; 3, belt insulation, 0·020 in.; 4, conductor insulation, 0·035 in.

Experimental Installations

One surprising example is that there are now in England at least two experimental installations of plastics underground distribution cables with concentric neutrals, recognising the economy which the concentric neutral construction brings—that with a concentric neutral a separate armour or earthed screen is unnecessary. This is in spite of the fact that for a concentric neutral system, a paper-insulated cable with aluminium sheath is intrinsically superior to a plastics-insulated cable with a stranded concentric outer. First, because the integrity of the neutral, so necessary to safety, is guaranteed—damage to it would allow moisture into the cable and a shutdown would result. Second, because its full section is always in circuit—with a stranded neutral a reverse-lay equalising tape must be applied, or the strands must be applied in two layers with opposite lay to ensure that when faults occur fault currents are not confined to two or three strands only.

Concentric Neutral Cables

For many years a three-core, aluminium-sheathed cable with the sheath used as a concentric neutral has been clearly the cheapest construction of cable for low voltage distribution, yet it has never been used in England. Jointing it has been held to introduce complications and expense. Fig. 4 compares a four-core, lead-sheathed and armoured cable with a three-core, aluminium-sheathed cable of the same conductor size. Note that the sheath cross-section is greater than that of the phase conductors. At present copper price levels, the four-core, lead-sheathed aluminium conductor cable illustrated is an economic construction which is being widely used in England. It is

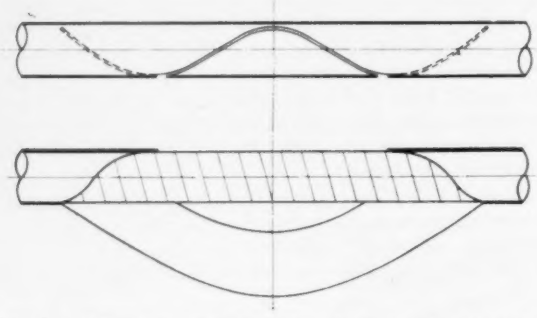


Fig. 5. Helical slit cut in aluminium sheath to expose insulation. Continuity as a current-carrying neutral is not affected

something over 15% cheaper than an equivalent cable with copper conductors. Yet the three-core, aluminium-sheathed cable would be more than 20% cheaper still, or about two-thirds as expensive as the four-core copper cable, which would still be regarded by many users in England as "standard practice."

Surely this great saving provides an incentive for developing simpler methods of jointing that would make this construction of cable attractive to supply engineers.

The traditional method of making a service joint on a concentric neutral cable is first to provide neutral continuity by wiping onto the sheath, across the length of the joint, a flexible copper jumper, then removing the sheath between the wipes and finally sweating the service leads to the phase conductor and neutral jumper. A lead or copper sleeve is then wiped over the complete joint, making a "trousers" joint, or the joint is enclosed in a compound-filled cast iron joint box.

Figs. 3 and 5 suggest a method that is much simpler. This method is in use in Germany. It was described by H. Heumann, of Kabelwerke Rheydt, at a VDEW conference of cable engineers held in Nuremburg in October, 1959, and reported in the VDEW Journal *Elektrizitats Wirtschaft* for June, 1960. Fig. 5 shows how a helical slit is cut in the aluminium sheath and the sheath then opened out to expose the insulation without interrupting its continuity as a conductor. Fig. 3 shows how a service connection (a four-conductor plastics-insulated cable in this instance) is then made using mechanical connectors, again without cutting any current-carrying conductor and without applying heat. The joint is encased in a cast iron box, its entries sealed with tape and the whole box filled with compound.

This joint seems to offer economy and elegance as well as robustness. Perhaps it will soon be tried out in this country.

Industrial Accidents in 1959

IMPROVEMENT in electrical design and safety techniques is reflected in the annual report for 1959 of the Chief Inspector of Factories. Despite an increase in the use of electricity during this period, the number of electrical accidents reported was little greater than in the previous year. Total accident figure for 1959 was 738 compared with 714 in 1958, but there was a welcome decrease in fatalities of the previous year from 38 to 34 in 1959. Against this, the total of all types of accidents reported for industry was 174,071 in 1959, 598 of which were fatal.

Reported Electrical Accidents: Analysis by Apparatus 1959

APPARATUS	FATAL	TOTAL
PORTABLE AND TRANSPORTABLE APPARATUS		
Hand and transportable tools	4	60
Heaters and irons	–	6
Lamps	5	12
Testing sets, including lamps, instruments and test leads	–	29
Plugs, sockets, couplings and adaptors	4	32
Cables and flex for portables (other than test sets)	2	25
Electric hand welding, shock and burn only	–	18
FIXED APPARATUS		
Electrical rotating machines	–	4
Transformers and reactors	–	6
Switchgear above 650 volts	2	37
Switchgear below 650 volts	–	132
Fusegear	2	36
Crane and other trolley wires, etc.	2	28
Fixed lamps	–	19
Cables and accessories (excluding cables and flexibles, etc. for portable apparatus)	1	78
Test leads, test terminals, etc. (for non-portable test equipment)	1	13
Electronic, telecommunication and H.T. equipment	2	14
Secondary batteries, etc.	–	6
OVERHEAD TRANSMISSION AND DISTRIBUTION LINES		
(a) Contact by cranes or similar machines	6	8
(b) Direct contact by persons or materials and tools	4	8
Apparatus not classified	1	24
Totals	36	595
Electric welders' eyeflash (conjunctivitis)	–	143
Totals	36	738

Common Causes

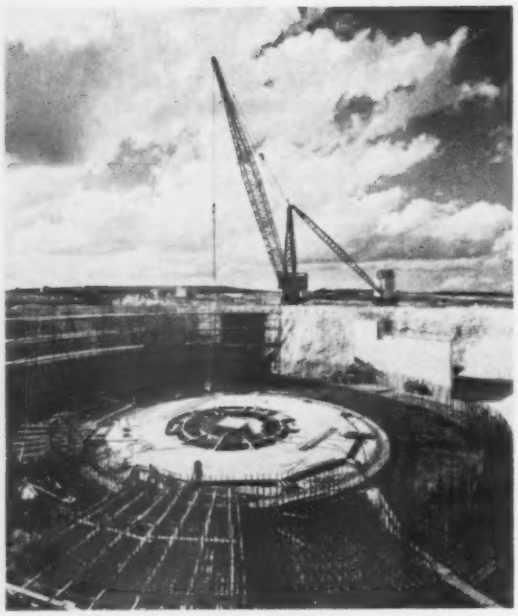
As in past years, contact with overhead line conductors was fairly high on the list of accident causes. Mobile cranes and other vehicles used in civil engineering construction seemed mainly to have been involved. Unfortunately, in these cases the fatality rate was high due to the higher voltages involved. Portable electric tools and lamps were again responsible for a high proportion of accidents, which included a number of fatalities. A significant increase in electrical accidents involving women is recorded, amounting to 40 in 1959 compared with an average of 30 over the previous 12 years. This reflects the greater employment of women for routine electrical testing, and the report implies that the majority of these accidents were due to trivial faults in plugs, sockets and flexible cables; test apparatus, however, was found well designed from the safety aspect.

Accidents other than electric shock resulting from faulty equipment are also mentioned in the report. An instance of this was sparking of thermostat contacts not in a flame-proof enclosure causing an explosion in a propane gas plant. Apart from a few cases of accidental exposure to ionising radiation, as far as industrial health is concerned, electricity shows a relatively clean sheet. The report points out that two of the three incidents of radiation exposure reported could have been obviated if the X-ray apparatus concerned had been fitted with a suitable safety interlock.

Enhanced Safety

On the credit side, electricity played an important part in industrial safety as a whole. Improved reliability of semi-conductor and other electronic devices enabled greater sophistication in control and warning systems for both industrial processes and electricity supply, with a consequent increase in safety standards.

Published with the report is the inspectorate's "Guide to Statistics," which explains the new method adopted for statistical presentation of accident data.



Heavy reinforced concrete foundations for the international Dragon reactor project, now under construction at Winfrith

Research for New Reactors

U.K.A.E.A. WINFRITH HEATH ESTABLISHMENT SUPPLIES FACTS FOR DESIGNERS

WINFRITH HEATH is the UK Atomic Energy Authority's second Harwell. Like that establishment, it is part of the Authority's research group, but whereas Harwell is now mainly concerned with nuclear physics in the broadest sense, and with fundamental materials research associated with applications of nuclear phenomena, all the work planned for Winfrith Heath is related directly to nuclear reactors. This was made clear by the director, Mr D. W. Fry, when we visited the establishment last week to see the progress achieved since construction started in September, 1957.

Winfrith Heath has, of course, received considerable publicity as the home of the co-operative Dragon project, the OEEC-sponsored development plan for a high-temperature reactor; but its work extends far more widely. Some of it is designed to yield the information needed by the UKAEA in their capacity as consultants to the Government and others on nuclear power; some to provide basic information in the development of types of reactor already selected for use in the CEGB system; while some is in the nature of development work relating to the complex technology of reactor systems. On this work is employed a staff totalling 1,870.

Much of the work is carried out through experiments with reactor systems. Not in general power-producing reactors, but exponential and sub-critical assemblies, in which an external supply of neutrons has to be arranged, or zero energy reactors, which operate at power levels of a few watts only.

Co-operative Studies

Typical of the detailed work being carried out, but taken further than most of it, is the study of reactor physics in connection with the Magnox nuclear power stations now being built for the CEGB, and their immediate successors, the advanced gas-cooled reactors. There is a programme in hand that represents close co-operation between the UKAEA and the nuclear engineering consortia under the title BICEP (British Industries Collaborative Engineering Programme).

Five items of nuclear experimental apparatus give an idea of the work carried out. First comes an arrangement, an "exponential stack," in which graphite bricks can be built up to determine the effect of various moderator arrangements in a reactor. This is instrumented with boron fluoride counters to determine how the moderator affects distribution of neutrons provided from an external source. A somewhat similar stack is the "fine structure" stack, in which attention is focused on a single lattice unit, to determine the finer details of neutron distribution. This second stack needs a higher neutron density than the other device and has to be protectively shielded.

SCORPIO is the name given to two assemblies used to predict the behaviour of reactor cores containing plutonium as well as uranium. Plutonium is produced as a consequence of irradiation of natural uranium fuel in a reactor and its effect varies with temperature. SCORPIO I is used to predict the critical size of power reactors—that at which the nuclear reaction is just self-sustaining—after various periods of operation. Lattice geometry, proportion of plutonium to uranium, and temperature will all be varied under closely controlled conditions in an apparatus designed to operate at temperatures up to 400°C. A smaller but generally similar equipment, SCORPIO II, is a sub-critical assembly which provides details of local variations of neutron distribution within the repeating lattice units.

The final item in this BICEP list is a differentially heated graphite assembly. Here the idea is to help formulate a theory for the way changes in graphite properties with temperature affect the physics of a power reactor. There is a large block of graphite, within which tubes of various materials, notably graphite and beryllium, are heated electrically. Neutrons from an antimony-beryllium source beneath the block diffuse through the assembly and neutron characteristics within the tubes are measured. The results are particularly relevant to advanced reactors operating at higher temperatures.

Advanced Studies

Reactors and other nuclear assemblies outside the BICEP group are designed to give information about reactor systems more sophisticated in concept. An example is HELEN, a sub-critical assembly which has the object of facilitating study of the reactor physics of systems moderated by ordinary (light) water or by organic liquids, and with fuels which are enriched to a higher content of fissile material, including plutonium. It comprises plutonium-aluminium alloy fuel suspended in a tank con-

taining a liquid moderator. A neutron source is provided below the tank and neutron measurements give information on how theory fits with reality for various arrangements.

A more intense source of neutrons than is used for HELEN and the other assemblies so far described is required for some experiments, and NESTOR is being built to give such a source. It is a 10 kW reactor with the purpose of giving an intense beam of neutrons which can be directed into any of five experimental assemblies placed around it. Each assembly will be capable of isolation from the neutron beam.

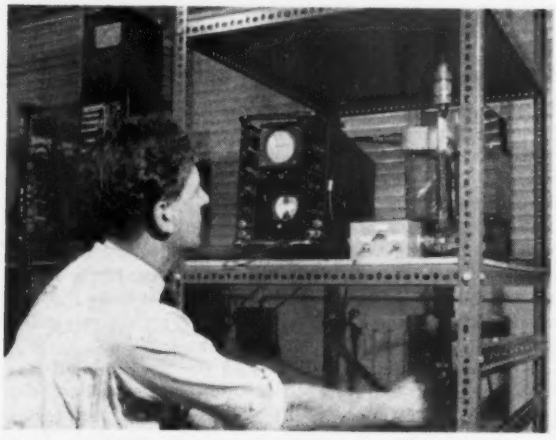
Another way of gaining information about nuclear behaviour of materials, particularly suitable when only a small quantity is available, is to oscillate a sample in and out of a core of a reactor and observe the effect this has on the neutron flux. HECTOR, described recently in the ELECTRICAL TIMES, is to be built for these types of experiment. It will provide the facility of a closely controllable temperature up to the high values likely to become important in nuclear reactors in the future. Doing somewhat the same job at room temperature is NERO, a zero energy reactor which has been moved from Harwell where it was operating previously.

Not all reactor physic problems can be tackled with such relatively simple assemblies and reactors as those described. In particular, problems of kinetic behaviour and of control are likely to require more complex zero energy reactors. The most notable reactor in this field at the Winfrith establishment is ZENITH, which is associated with the DRAGON project. It is a reactor provided with helium coolant and an electric heater to increase gas temperature so that the information necessary for design of the high-temperature DRAGON core can be obtained with minimum uncertainty about nuclear characteristics.

Another sizeable zero energy reactor is DIMPLE, which has been operating at Harwell and will be moved to Winfrith next year. DIMPLE is suitable for basic studies using liquid moderators. A third is ZEBRA, which will be used for study of possible core configurations for fast breeder reactors in which no moderator is used.

Fuel, Cooling and Control

It is not enough to supply the reactors. An important ancillary part of the Winfrith activity is to prepare the special fuel samples on which experiments are to be carried out. For example, a small laboratory is being set up in which plutonium and fissile isotopes of uranium can be handled as well as other special materials. Attention is also being given to techniques for joining graphite, for example, for use in high-temperature reactors.



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In the control field, apart from the continuing desire for closer and simpler control, there are new problems emerging which arise from the higher temperatures and new materials that will come into use with more advanced reactors. Radically new instrumentation techniques may prove important for these circumstances and the principles governing control system design must be formulated in advance of detailed consideration of reactor design.

Dragon

So far, only incidental mention has been made of the DRAGON project; yet the international assembly of engineers and scientists working together on this scheme is one of the most impressive features of Winfrith Heath. (It was described in the ELECTRICAL TIMES of 18 August.) The project operates under a board of management representing the six nations plus Euratom (representing another six countries). It has a British chief executive, a Norwegian head of administration, a Euratom-appointed chief engineer and a British scientist in charge of research and development. The project involves design and erection of a helium-cooled reactor provided with graphite-contained fuel and operating at a core temperature as high as 1,500°C (2,730°F). The preliminary investigations for the design in the ZENITH zero energy reactor are being carried out by the UKAEA under a contract with the project management.

Heavy reinforced concrete foundations for the international Dragon reactor project, now under construction at Winfrith

Research for New Reactors

U.K.A.E.A. WINFRITH HEATH ESTABLISHMENT SUPPLIES FACTS FOR DESIGNERS

WINFRITH HEATH is the UK Atomic Energy Authority's second Harwell. Like that establishment, it is part of the Authority's research group, but whereas Harwell is now mainly concerned with nuclear physics in the broadest sense, and with fundamental materials research associated with applications of nuclear phenomena, all the work planned for Winfrith Heath is related directly to nuclear reactors. This was made clear by the director, Mr D. W. Fry, when we visited the establishment last week to see the progress achieved since construction started in September, 1957.

Winfrith Heath has, of course, received considerable publicity as the home of the co-operative Dragon project, the OEEC-sponsored development plan for a high-temperature reactor; but its work extends far more widely. Some of it is designed to yield the information needed by the UKAEA in their capacity as consultants to the Government and others on nuclear power; some to provide basic information in the development of types of reactor already selected for use in the CEGB system; while some is in the nature of development work relating to the complex technology of reactor systems. On this work is employed a staff totalling 1,870.

Much of the work is carried out through experiments with reactor systems. Not in general power-producing reactors, but exponential and sub-critical assemblies, in which an external supply of neutrons has to be arranged, or zero energy reactors, which operate at power levels of a few watts only.

Co-operative Studies

Typical of the detailed work being carried out, but taken further than most of it, is the study of reactor physics in connection with the Magnox nuclear power stations now being built for the CEGB, and their immediate successors, the advanced gas-cooled reactors. There is a programme in hand that represents close co-operation between the UKAEA and the nuclear engineering consortia under the title BICEP (British Industries Collaborative Engineering Programme).

Five items of nuclear experimental apparatus give an idea of the work carried out. First comes an arrangement, an "exponential stack," in which graphite bricks can be built up to determine the effect of various moderator arrangements in a reactor. This is instrumented with boron fluoride counters to determine how the moderator affects distribution of neutrons provided from an external source. A somewhat similar stack is the "fine structure" stack, in which attention is focused on a single lattice unit, to determine the finer details of neutron distribution. This second stack needs a higher neutron density than the other device and has to be protectively shielded.

SCORPIO is the name given to two assemblies used to predict the behaviour of reactor cores containing plutonium as well as uranium. Plutonium is produced as a consequence of irradiation of natural uranium fuel in a reactor and its effect varies with temperature. SCORPIO I is used to predict the critical size of power reactors—that at which the nuclear reaction is just self-sustaining—after various periods of operation. Lattice geometry, proportion of plutonium to uranium, and temperature will all be varied under closely controlled conditions in an apparatus designed to operate at temperatures up to 400°C. A smaller but generally similar equipment, SCORPIO II, is a sub-critical assembly which provides details of local variations of neutron distribution within the repeating lattice units.

The final item in this BICEP list is a differentially heated graphite assembly. Here the idea is to help formulate a theory for the way changes in graphite properties with temperature affect the physics of a power reactor. There is a large block of graphite, within which tubes of various materials, notably graphite and beryllium, are heated electrically. Neutrons from an antimony-beryllium source beneath the block diffuse through the assembly and neutron characteristics within the tubes are measured. The results are particularly relevant to advanced reactors operating at higher temperatures.

Advanced Studies

Reactors and other nuclear assemblies outside the BICEP group are designed to give information about reactor systems more sophisticated in concept. An example is HELEN, a sub-critical assembly which has the object of facilitating study of the reactor physics of systems moderated by ordinary (light) water or by organic liquids, and with fuels which are enriched to a higher content of fissile material, including plutonium. It comprises plutonium-aluminium alloy fuel suspended in a tank con-

taining a liquid moderator. A neutron source is provided below the tank and neutron measurements give information on how theory fits with reality for various arrangements.

A more intense source of neutrons than is used for HELEN and the other assemblies so far described is required for some experiments, and NESTOR is being built to give such a source. It is a 10 kW reactor with the purpose of giving an intense beam of neutrons which can be directed into any of five experimental assemblies placed around it. Each assembly will be capable of isolation from the neutron beam.

Another way of gaining information about nuclear behaviour of materials, particularly suitable when only a small quantity is available, is to oscillate a sample in and out of a core of a reactor and observe the effect this has on the neutron flux. HECTOR, described recently in the ELECTRICAL TIMES, is to be built for these types of experiment. It will provide the facility of a closely controllable temperature up to the high values likely to become important in nuclear reactors in the future. Doing somewhat the same job at room temperature is NERO, a zero energy reactor which has been moved from Harwell where it was operating previously.

Not all reactor physic problems can be tackled with such relatively simple assemblies and reactors as those described. In particular, problems of kinetic behaviour and of control are likely to require more complex zero energy reactors. The most notable reactor in this field at the Winfrith establishment is ZENITH, which is associated with the DRAGON project. It is a reactor provided with helium coolant and an electric heater to increase gas temperature so that the information necessary for design of the high-temperature DRAGON core can be obtained with minimum uncertainty about nuclear characteristics.

Another sizeable zero energy reactor is DIMPLE, which has been operating at Harwell and will be moved to Winfrith next year. DIMPLE is suitable for basic studies using liquid moderators. A third is ZEBRA, which will be used for study of possible core configurations for fast breeder reactors in which no moderator is used.

Fuel, Cooling and Control

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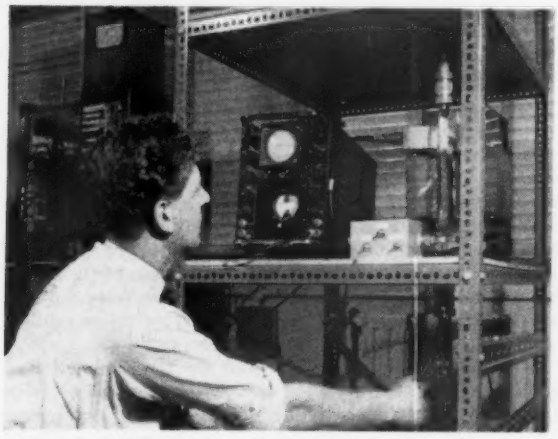

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NOTES ON WIRING

BY MEGOHM

IN laboratories and technical schools it is often desirable to have several different voltages or frequencies, all of which are required to be non-interchangeable not only amongst themselves but with any plug and socket made to BS. I saw a range of such plugs and sockets recently which had been installed in a research laboratory and covered four voltages, 24, 50, 110 and 240 V. They were capable of taking a maximum load of 13 A.

The tubes of the sockets were the key to their non-interchangeable nature; for instance, the 24 V socket had round holes for the live and neutral whilst the third tube was rectangular in shape. The 50 V socket had the right hand tube different from the left and the 110 V socket was different again.

I saw double twin sockets mounted into the plinths of the benches with four different sockets for the four voltages available. These are a great improvement from the normal low-voltage units used in technical schools in the past but I feel that it may be some time before they are adopted as standard equipment. I find that authorities are very slow moving where changes like these are suggested. Very often the planners are blamed for being behind the times when, in fact, their hands are tied and the older type of equipment "must be used." I realise, of course, that there is this strong desire to standardise an equipment but I would like to see a more modern approach.

Home Heating Control

A friend of mine who, like myself, enjoys comfort during the winter, showed me a new thermostat which he has installed in his home. It is called a clock thermostat and the name describes it adequately for it is just a combination of a clock and a thermostat. The manufacturer claims that the unit will raise the room temperature to your chosen daytime level at any preset time after maintaining a healthily low temperature during the night. My friend has tried out the control and checked the temperatures for a few weeks now and found it very satisfactory. The claim by the manufacturer that the unit will cut down costs is still to be confirmed.

I was interested in the elegant styling of the unit as well as its uses. It is neat, quite small with a clear clock face and temperature markings. Of course, wiring has to be run to it and this is usually when the trouble starts. It is all very nice to hold such a unit as described above in position and inform the client that it will look like that when fixed, but forget to let it be known that the wiring may have to be run on the surface.

I have been trying out another controlling device recently. This device consists of a timer which is set to switch on a fire, radio or other apparatus in anything up to 12 hours' time. The device is not in fact a clock but more of a unit which operates for the number of hours required, then switches the current on. I have found it reliable, but it is bulky and not at all nice to fix in a room. I have the device mounted on a wood block with a socket fixed alongside and a short length of flexible cord and a plug attached. This allows me to use the arrangement anywhere in the house, on any of my fires. I am thinking of fixing one near the fuseboard to control the heater in the bathroom during the winter. I often wonder if the ordinary householder is made sufficiently aware of what can be achieved by electrical control devices such as these described above.

Plastics Conduits

There appears to be a growth of interest in plastics conduits lately. With the development of oval plastics conduits, certain contractors in the north are using them on houses, etc., in preference to the normal p.v.c.-sheathed cables. I am not in a position to comment on the financial aspects of the two systems but I can see much in favour of the plastics conduits on the practical side of things. Personally I dread the day when I have to have my ground-floor flat rewired. The present system is a p.v.c.-sheathed cable system with the drops to switches and sockets protected with steel channel. I can see how to overcome the difficulty of renewing the wiring in the ceilings but the switch-drops are a more difficult problem. Very little consideration has been given to the possibility of a rewire in the future and I feel that the installation was done with nothing but cheapness and profit in mind. Of course we are all in the business to make money, but with a little extra thought such a problem of a rewire could have been considered.

Plastics conduit appears to me to be economical enough to make its use in domestic installations well worth while considering. Such installations are cheap because of the need to keep the overall costs of new houses down to a minimum and it would be interesting to learn if architects have considered the use of plastics conduits in the houses which they design.

The technique of installing plastics conduits are not complicated and should not prove a stumbling block to the very small contractor who is usually the person concerned on domestic work. I wonder how far it is possible to get people to use these conduits in such installations, bearing in mind that they do cater for a rewire.

New Earthing Arrangement on Sockets

I was shown a socket this week which I feel I ought to comment upon. This socket is made by a manufacturer whose name is really a household word in the contracting industry. This socket is not new but has been modified at the request of certain authorities who have authorised the use of the boxes which have one fixing lug made of nylon to afford ease of adjustment. The modification is simple yet so necessary in such situations and consists of the earthing arrangements being taken to each of the holes through which the retaining screws pass. This avoids the possibility of losing earth continuity at metal box positions.

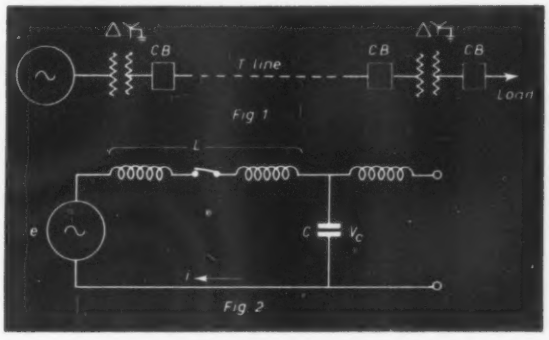
This same manufacturer showed me an insulated box which had been made to test reaction in the trade. I was asked if I thought there might be a market for such a box and, at that time, my answer was in the negative. However, since then my contacts in the north have pointed out the matter of the plastics conduits and, quite frankly, I am beginning to have second thoughts on the matter.

Over-voltages in h.v. lines

STUDIES OF FERRO-RESONANCE AND RESTRIKING

by T. V. Sreenivasan,* B.E., M.Sc.Tech., A.M.I.E.

IN h.v. power systems, over-voltages due to switching operations are as important as those due to lightning. With the improvement in the performance of lightning arresters, which are primarily meant for protection against lightning surges, more attention is now being given to switching surges. Over-voltages due to switching operations affect not only the system insulation but also lightning arrester performance. In the present article, only two cases of over-voltages due to internal causes are considered. In the first case, a restrike is assumed in the circuit-breaker operation while opening an unloaded transmission line, and in the second case the over-voltage is due to resonance when the secondary side of the receiving-end transformer of a long transmission line is opened. Fig. 1 shows the system assumed in both cases.



Figs. 1 and 2. The power system (top) and the equivalent circuit representing it (below)

List of symbols:

e	=	Instantaneous value of the generated voltage.
i	=	Instantaneous value of the current.
l	=	Length of the line in miles.
L	=	Inductance of the system.
C	=	Capacitance of the transmission line.
L_l	=	Inductance of the transmission line.
f	=	Fundamental frequency.
ω	=	$2\pi f$
ω_n	=	$1/\sqrt{(LC)}$.
V_c	=	Transmission line-to-neutral voltage.
jx_g	=	Reactance of the sending end generator and transformer.

Unloaded Transmission Line

For the first study, generator, transformer and line resistance and corona formation are neglected. Referring to Fig. 2, where the transmission line is replaced by a nominal-T network and reckoning time from the instant at which the current passes through zero.

$$e = -\sqrt{2}\cos\omega t;\ i = (\sqrt{2}\sin\omega t)\Big/\left(\frac{1}{\omega C}-\omega L\right)$$

When the current is zero, at $t = 0$

the voltage across the capacitor, $V_c = -\sqrt{2}/(1-\omega^2LC)$ (1)

This potential is trapped in the transmission line, and neglecting all leakage, the voltage across the circuit-breaker contacts after the first current interruption and before restrike occurs is given by

$$V_r = -\sqrt{2}\cos\omega t + \sqrt{2}/(1-\omega^2LC)$$

This is maximum when $t = 180°$ and is equal to $\sqrt{2}\{1+1/(1-\omega^2LC)\}$ If at this instant restrike occurs, reckoning time from this onwards,

$$\sqrt{2}\cos\omega t + \sqrt{2}/(1-\omega^2LC) = L\frac{di}{dt} + \frac{1}{C}\int i\,dt$$

The steady state value is given by $i_s = -(\sqrt{2}\sin\omega t)\Big/\left(\frac{1}{\omega C}-\omega L\right)$

The transient value is given by $i_t = A\sin(\omega_n t\ \theta)$

when $t = 0$, $i = 0$. Hence $g = 0$

$$\therefore\ i_t = -\frac{\sqrt{2}\sin\omega t}{\left(\frac{1}{\omega C}-\omega L\right)} - A\sin\omega_n t$$

$$V_c = e - L\frac{di}{dt} = \sqrt{2}\cos\omega t + \frac{L\omega\sqrt{2}\cos\omega t}{\left(\frac{1}{\omega C}-\omega L\right)} + AL\,\omega_n\cos\omega_n t$$

When $t = 0$ $V_c = -\sqrt{2}/(1-\omega^2LC)$.

Hence $AL\omega_n = -\dfrac{2\sqrt{2}}{(1-\omega^2LC)}$

$$V_c = \frac{\sqrt{2}}{1-\omega^2LC}\cos\omega t - \frac{2\sqrt{2}}{1-\omega^2LC}\cos\omega_n t \qquad .. \quad .. \quad (2)$$

where $\omega_n = \dfrac{1}{\sqrt{LC}}$

Assuming the following numerical values for the power system shown in Fig. 1, numerical computations are carried out for the case when the length of the transmission line is 100 miles and also when it is 300 miles.

Generator and transformer reactance 30%.
Power line voltage 132 kV frequency 50 c/s.
Conductor—ACSR 37/0·126. Equivalent delta spacing, 15 ft.

Resistance per mile length of conductor	0·162 ohm
Inductance per mile length of conductor	1·98 mH
Capacitance per mile length of conductor	0·015 microfarad

For 100 mile length of line

$$V_c = 1{\cdot}6\cos 314\,t - 3{\cdot}2\cos 930\,t$$

This reaches a maximum value 4·0 p.u. or 2·85 times normal crest value 3·1 milliseconds after restriking had taken place.

For a 300 mile line

$$V_c = 2{\cdot}5\cos 314\,t - 5{\cdot}00\cos 500\,t$$

This is shown plotted in Fig. 3 and reaches a maximum value of 6·85 p.u. or 4·85 times normal crest value in 12 milliseconds after restriking had taken place.

* Mr Sreenivasan is Assistant Professor of Electrical Engineering at the Indian Institute of Technology, Kharagpur, West Bengal.

Damping Due to Resistance and Corona

Until a restrike takes place, the effect of corona and system resistance is considered negligible. After restriking, the effect of system resistance and an equivalent shunt resistance across the capacitor (between the line and neutral) which will cause approximately the same power loss as that due to corona is considered. Obviously, this approximation is loose, as the loss and current in a resistance cannot simulate the corresponding quantities due to corona.

Referring to Fig. 4, proceeding as before, after restriking,

$$\sqrt{2}\cos\omega t + \sqrt{2}/(1-\omega^2LC) = L\frac{di}{dt} + ir + (i-i_c)R$$

$$\frac{1}{C}\int i_c\,dt = (i-i_c)R$$

Eliminating i from these two equations

$$-\omega\sqrt{2}\sin\omega t = L\frac{d^2i_c}{dt^2} + \frac{di_c}{dt}\left(r + \frac{L}{RC}\right) + \frac{R+r}{RC}i_c$$

The steady state value is given as in the previous case neglecting the effect of r and R

$$i = i_c = -(\sqrt{2}\sin\omega t)\Big/\left(\frac{1}{\omega C} - \omega L\right)$$

Transient value is given by

$$i_t = A\,e^{-\omega_n Dt}\sin(\omega_n\sqrt{1-D^2}\,.\,t + \theta)$$

where $\omega_n = \dfrac{1}{\sqrt{LC\dfrac{R}{R+r}}}$ and $D = \frac{1}{2}\left(r + \dfrac{L}{RC}\right)\sqrt{\dfrac{RC}{(R+r)L}}$

Since when $t = 0$, $i_c = 0$ $\theta = 0$

Hence

$$i_c = -\left\{\sqrt{2}\sin\omega t\Big/\left(\frac{1}{\omega C} - \omega L\right)\right\} + Ae^{-\omega_n Dt}\sin\omega_n\sqrt{1-D^2}t$$

$$\therefore V_c = \frac{1}{C}\int i_c\,dt = \frac{1}{C}\left[\frac{\sqrt{2}}{\left(\frac{1}{\omega C} - \omega L\right)\omega}\cos\omega t - \frac{Ae^{-\omega_n Dt}}{\omega_n}\sin\left(\omega_n\sqrt{1-D^2}t + \tan^{-1}\frac{\sqrt{1-D^2}}{D}\right)\right]$$

when $t = 0$, this should be equal to $-\dfrac{\sqrt{2}}{1-\omega^2LC}$

Hence $A = \dfrac{2\sqrt{2}\,\omega_n}{(1-\omega^2LC)\sqrt{1-D^2}}$

$$\therefore V_c = \frac{\sqrt{2}}{1-\omega^2LC}\cos\omega t - \left\{\frac{2\sqrt{2}}{(1-\omega^2LC)\sqrt{1-D^2}}e^{\omega_n Dt}\sin\left(\omega_n\sqrt{1-D^2}t + \tan^{-1}\frac{\sqrt{1-D^2}}{D}\right)\right\} \quad \ldots \quad (3)$$

Since R would be very large compared with r

$$\omega_n \simeq \frac{1}{\sqrt{LC}} \text{ and } D \simeq \frac{r}{2Z_s} + \frac{z_s}{2R}$$

According to available data, it seems reasonable to assume that the corona loss for such high voltages may be expressed as $C_1(E-E_0)^2$ where C_1 is a constant for the line in question, E_0 the critical disruptive voltage and E the voltage to neutral of the conductor. With this assumption, R may be expressed as

$$10^3/C_1\left(1 - \frac{E_0}{E}\right)^2$$

A specific example:

For the same case as before, for 100 mile length

$$r = 8{\cdot}1 \text{ ohm}$$

C_1 and E_0 in Peek's corona loss formula work out to 0·0156 per mile and 135 kV r.m.s. to neutral, respectively. Assuming an average value for E as about twice the normal value, which would result in a corona loss of about 4·75 kW per mile conductor. R is about 4×10^4 per 100 mile.

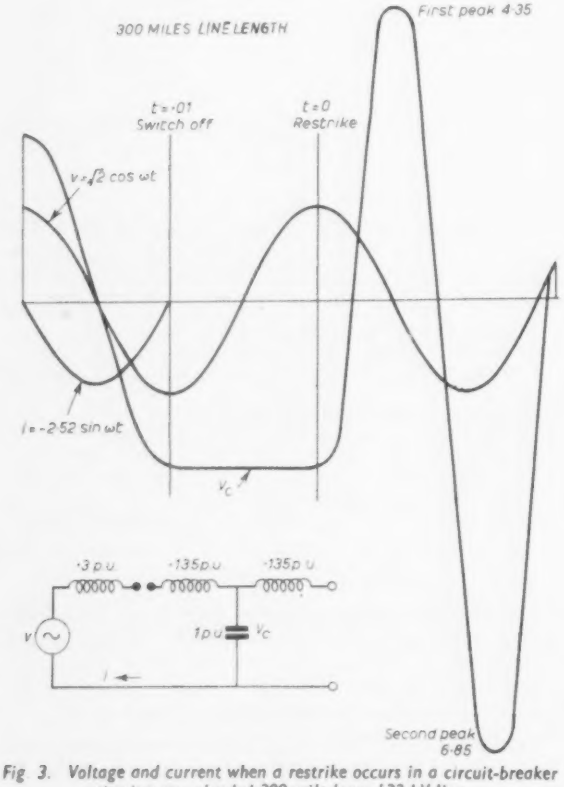


Fig 3. Voltage and current when a restrike occurs in a circuit-breaker opening an unloaded 300 mile long, 132 kV line

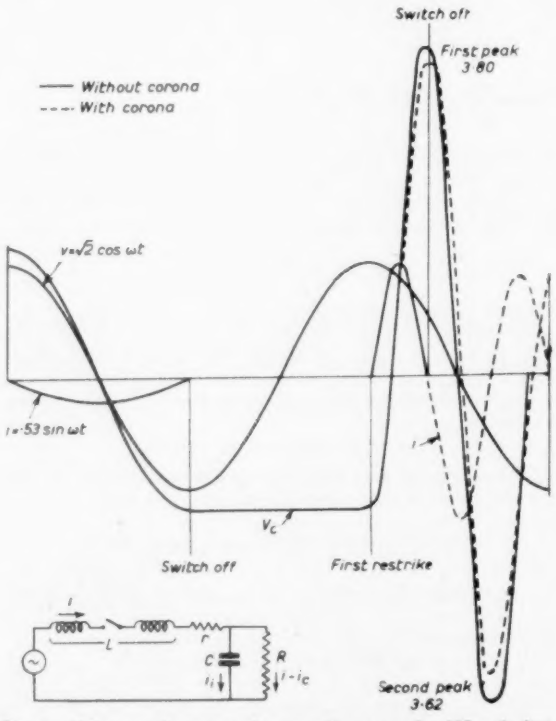


Fig. 4. Voltage and current when restrike occurs for 100 mile line, allowing for damping due to resistance and corona

$$w_n D = 18{\cdot}3$$

Then $V_c = 1{\cdot}6 \cos 314\ t - 3{\cdot}2\ e^{-18{\cdot}3\ t} \cos (930\ t + 0{\cdot}0057)$

This is shown in Fig. 4 and reaches a maximum value of 3·8 p.u. or 2·7 times normal crest value 3·3 milliseconds after restrike.

Under these conditions and assumptions the effect of corona is in parallel with the effect of line resistance. The conductor diameter chosen is too large for a normal 132 kV line and is more suitable for a 220 kV line. If 220 kV had been chosen as the normal line voltage, the effect of corona would have been more prominent.

Similarly, for a 300 mile line, the equation works out to

$$V_c = 2{\cdot}5 \cos 314\ t - 5{\cdot}0\ e^{-48{\cdot}7\ t} \cos (500\ t + 0{\cdot}0282)$$

This is plotted in Fig. 5 and reaches a maximum value of 4·75 p.u. or 3·35 times the normal crest value 11·6 milliseconds after restriking takes place.

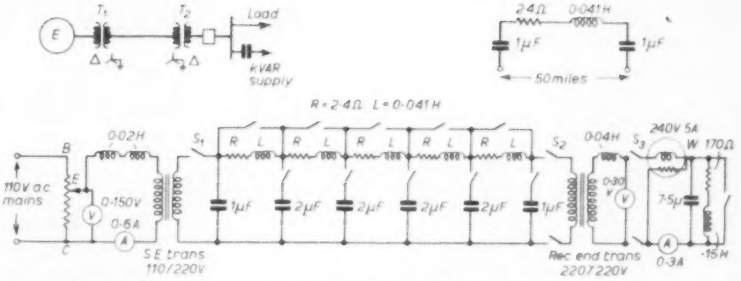


Fig. 6. Miniature power system constructed to represent transmission line

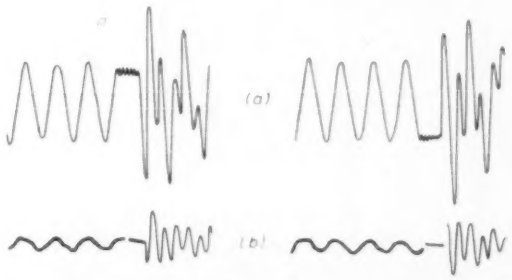


Fig. 7. Typical oscillograms obtained from miniature system of Fig. 6. (a) voltage wave and (b) current wave for dropping an unloaded line 250 miles long with single restrike

Miniature System Study

A miniature power system consisting of transformers, air cored inductances and capacitors was constructed (Fig. 6) to represent a transmission line with the following particulars:

Single circuit line 50 miles to 250 miles long.
Conductor ACSR 37/·146. Spacing 22ft.
Resistance at 50 c/s—0·14 ohm/mile.
Inductance —2·26 mH/mile.
Capacitance —0·014 mfd/mile.

The steady state sending-end and receiving-end voltages are assumed to be held constant at 1 p.u. and the full load is 90 MW at 0·9 p.f. lag.

In the miniature system the distributed constants of the transmission line are replaced by five 50-mile sections, and each 50-mile section replaced by a nominal-T configuration. The resistance, inductance and capacitance of each section work out to 7 ohm, 0·113 Henry and 0·69 mfd, respectively; but as only 2 mfd capacitors were available the resistance of each section was decreased to $7 \times 0{\cdot}69/2$, i.e., 2·4 ohm, and the inductance decreased to $0{\cdot}113 \times 0{\cdot}69/2$, i.e., 0·041 Henry, to keep the time constants RC and L/R unchanged. The voltage used on the model is 220 V, 50 c/s, so that if the full load of the transmission line is 100 MVA, that of this equivalent miniature system would be 0·872 kVA.

Over-voltages due to a single restrike in the circuit-breaker were investigated by closing the circuit of the miniature power system at the generating end through a slip-ring, a small sector of the metallic surface of which is replaced by an insulator. Whenever the collecting brushes come over the insulator the circuit is interrupted, and on entering the metallic portion, restriking is simulated. The speed of the slip-ring is suitably adjusted to give the time of restrike for the worst condition. In Figs. 7(a) and 7(b) are shown typical oscillograms obtained. The crest value of the over-voltages between 2 to 2·5 p.u. even though theoretical calculations indicate slightly higher values. This discrepancy may be due to discharging of the capacitors.

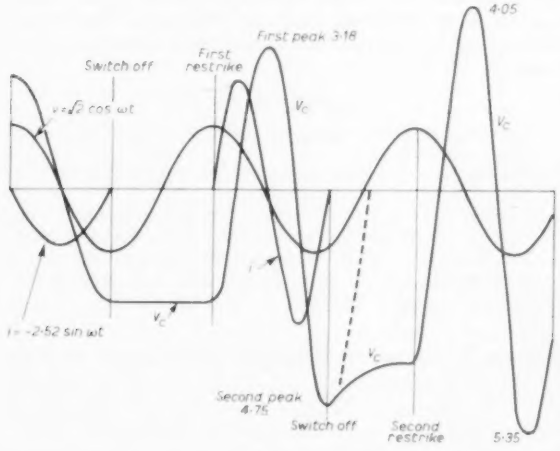


Fig. 5. Voltage and current when restrike occurs on 300 mile line allowing for damping due to resistance and corona

Over-voltages Due to Ferro-resonance

If in the power system shown in Fig. 1 only the circuit-breaker on the l.v. side at the receiving-end is opened, leaving the receiving-end transformer in circuit, this transformer may become over-excited due to rise in the open circuit fundamental frequency voltage. The voltage rises at the sending-end, due to loss of load, due to leading current taken by the transmission line and due to over-speeding. In Ref. 4 is calculated the p.u. fundamental frequency voltage behind sub-transient reactance, at the sending-end following load interruption, assuming an exciter response of 1 p.u. It is also assumed that the speed rises linearly from 1 p.u. at time zero to 1·075 p.u. at 0·6 second and thereafter remains constant. Due to this over-excitation the harmonic contents of the exciting current of the transformer are considerably increased. This may considerably increase the peak voltage due to resonance with the shunt capacitance of the transmission lines. Fig. 8 shows the equivalent circuit of such a power system with the transformer as the harmonic generator. The transmission line is replaced by a nominal-π network.

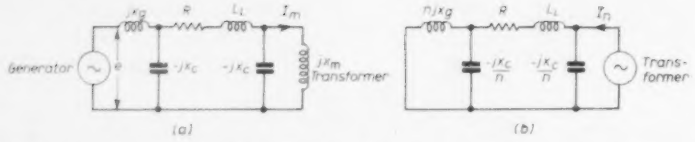


Fig. 8. Equivalent circuit power of system with transformer as harmonic generator. (a) equivalent circuit for fundamental; (b) for nth harmonic

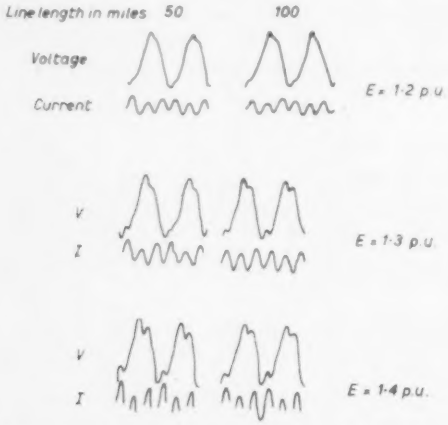


Fig. 9. Effect of fifth harmonic on crest voltage, as function of line length

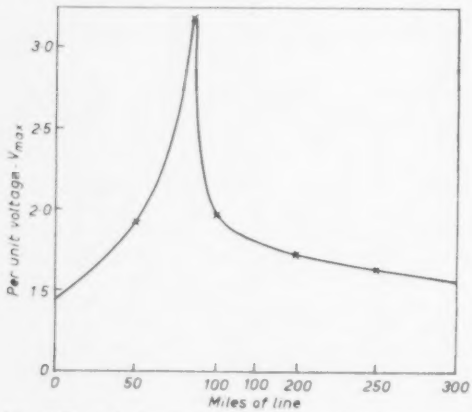


Fig. 10. Effect of harmonics on receiving-end voltage and current

Referring to the equivalent circuit shown in Fig. 8, where the reactances are all for the n^{th} harmonic current, the condition for resonance is

$$X_e = \{x_g x_c/(x_c - x_g)\} + x_L$$

From which $x_e^2 - 2x_c x_g - x_c x_L + x_L x_g = O$

If L is the length of the line $x_L = A \cdot l \cdot n$, $x_c = B/nL$ so that the condition for resonance may be expressed as

$$l^3 n^3 - l^2 n^2 \frac{B}{x_g} - \ln \frac{2B}{A} + \frac{B^2}{Ax_g} = 0 \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

From this, for any particular value of n, l can be calculated. If for these values of l and n, half the capacitive reactance is x_n, and the n^{th} harmonic component of the magnetising current is equal to I_n

then the n^{th} harmonic voltage is $I_n x^2_n/R$ . . . .(5)

Taking the specific case of fifth harmonic for the system under consideration, and assuming its value to be 3% of the full load current and that the effective resistance of the conductors is doubled due to harmonics and corona, Fig. 10 shows the crest value of the receiving-end voltage as the line length is altered. The voltage is maximum when the line length is about 86·5 miles.

Fig. 9 shows oscillograms of current and voltage waves obtained by operating the miniature power system under similar conditions. Even though the presence of prominent fifth harmonic is indicated, over-voltages as high as those indicated by Fig. 10 were not obtained since the critical conditions and circuit parameters could not be reproduced.

It is difficult to evaluate the magnitude of the fifth harmonic component of the magnetising current and the effect of corona. A step-by-step method of solution may be adopted for evaluation of the fifth harmonic component. As a first approximation, assuming sinusoidal voltage to be applied to the transformer terminals (say 1·3 or 1·4 p.u.) the magnetising current wave may be determined graphically. This wave may be analysed and the fifth harmonic component determined. For the curves and values assumed the magnetising current wave may be expressed as $100 \sin(\theta + 5{\cdot}3°) - 72{\cdot}2 \sin(3\theta + 6{\cdot}3°) + 39{\cdot}1 \sin(5\theta + 5{\cdot}8°)$ the fifth harmonic component coming out as 39·1% of the fundamental. Equation (5) gives the fifth harmonic voltage generated by the transformer for maintaining the fifth harmonic current in the external circuit. If this is combined with the applied voltage a more correct value and wave-shape of the voltage at the transformer terminals is obtained. The wave-shape of the magnetising current is graphically determined again, and analysed to determine a more accurate value for the magnitude of the fifth harmonic component.

Conclusions

Considerable over-voltages may occur due to restriking or following secondary switching. These are important not only in connection with insulation co-ordination but also in connection with the selection and rating of lightning arresters. They introduce a new element in the design of lightning arresters. No general rules can be laid down regarding the magnitude and nature of these over-voltages. Each power system has to be studied separately before the principles on which insulation co-ordination and rating of lightning arresters are based, can be finally decided.

The effect of corona is important when there is more than one restrike in the case of short lines and even in the case of single restrike in the case of long lines.

Acknowledgments

The experiments and calculations in connection with this paper were carried out by Mr N. V. Balasubramanium and Mr S. M. Bilgrami, final year students of the Indian Institute of Technology, Kharagpur, to whom the author expresses his thanks.

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Know-how on Mineral Insulated Cable

A POCKET-SIZED guide for all who carry out installations in mineral-insulated cable is offered by BICC at all their branch offices under the title "The Electrician's Mate." In much detail and with a wealth of specially prepared illustrations it suggests how to tackle both simple and difficult jobs with an eye on the avoidance of trouble in the future.

Lighting and road safety

A.P.L.E. PAPERS AND DISCUSSIONS AT FOLKESTONE

AN interesting examination of driving reactions of the average car driver in response to what he actually sees on lighted roads formed part of the very instructive paper, "Surfaces, Seeing and Driving; Some Recent Studies," presented by J. M. Waldram, B.SC., A.M.I.E.E., F.I.E.S., at the APLE Conference last week. The paper, read before a packed audience, was in two parts; the first dealt with the effect of changes in road surfacing practice on lighting techniques over the years, the second covered researches on driver reactions carried out by the author in collaboration with the Medical Research Council, Applied Psychology Research Unit and the Road Research Laboratory.

Road Surface Developments

Over the last 25 years there has been a marked change in the characteristics of road surfacing materials and techniques which have had a significant effect on road lighting techniques. In pre-war days, surfaces in common use tended to become polished by wear, resulting in a fairly high reflectance which presented to oncoming traffic defined areas of high luminance in the vicinity of lighting standards. Against these areas, traffic, other road users and obstacles stood out in silhouette. Working on this observed phenomenon, the late G. H. Wilson and others developed techniques which enabled them to produce street lighting of far better quality than heretofore at a cost well within the reach of civic budgets. By late 1939, some 2,500 miles of new road lighting on this principle had been laid down before the war-time black-out intervened.

In Britain, the non-cutoff system was universally adopted, in which the bright area was in form T-shape with a long tail, and this system also persisted in road installations for some time after the war. On the Continent, variations of the technique were employed in two other systems, cutoff and semi-cutoff, in which the shape of the brightness areas on the road surface was modified from the T-form. All of these systems gave good and economical lighting but, from the first, it was obvious that the systems were vulnerable to changes in road surfaces and, in fact, these changes were to come about as a result of studies by the Road Research Laboratory in the production of non-skid surfacing materials. The changes were not sudden but slow and insidious. Resurfacing of roads lit to pre-war standards with pre-war surfaces suddenly showed a diminution of general brightness without any change in the lighting installations and a continuation of the resurfacing programmes inevitably brought about a need for rethinking on road lighting techniques in general.

There is obviously no point in directing light on to a road surface which will not reflect it; to do so illuminates obstacles unnecessarily and causes needless glare. A study of the factors leads the author to the conclusion that non-cutoff lighting, which has served well for the last 20 years, may have to be strictly limited in use. It would appear that we must look to greater mounting height with much the same spacing as at present, brighter light sources and more careful control over the distribution for future main road installations.

Part of the display lighting columns and fittings on the Leas, Folkestone, during the APLE Conference

Reasons for Lighting

The principle justification for lighting roads is to make them safer both for the pedestrian and for traffic and it has been suggested that the only final answer as to the success of an installation must be in terms of the accident rates. The first part of the Report of the Experts Committee of the CIE points out that connection between lighting and road accidents is extremely tenuous; a more discriminating tool is needed. The correct approach to the problem of good lighting is to realise, first, that the lighting is not there to prevent accidents directly; it is to provide information to road occupants whereby they may be able to use the road without hazard to themselves or to others. The second step is to find out the sort of information the road-users require and to see to what extent that information can be furnished by the lighting.

Driver's Requirements

The author went on to describe the experiments which had been carried out in an endeavour to ascertain the sort of information the driver of a vehicle considered necessary to assist him in steering a safe path through traffic. This included runs through normal traffic in a car in which a photographic film of the route was taken in synchronism with a recorded commentary on what he saw by the driver, a record of his movements on clutch, brake and accelerator and, as a final check, a record of his eye movements in relation to the view before him through a technique developed by the MRC Applied Psychology Research Unit. The results of these experiments showed, fairly conclusively, that the information required fell into three general patterns; driving on empty roads, driving in medium traffic and driving in heavy and congested traffic.

In an empty road the driver mentally records the general run of the road and the presence of occasional objects

upon it or about to enter it from side roads. He maintains course by casual peripheral observation of the streamer effect of kerbs and white lines.

In medium traffic he becomes preoccupied by the gap through which he must manoeuvre his car in traffic ahead, the relative speeds of stationary and oncoming traffic as they approach him and the subconscious appreciation of movement of objects in the peripheral areas which are only casually appreciated until the movement attracts his attention as being a possible hazard in the next few yards. Much of this observation is the recognition of familiar patterns with which he is already supplied by his own memory store. He cannot and does not fixate everything he sees; he accepts much of the peripheral pattern at quite low detail; he concentrates on the view immediately ahead and most of the reactions to what he sees are semi-instinctive and without conscious thought and are coloured and motivated by his past experience. He can be, and often is, deceived by what he sees peripherally but lighting is not a factor which can alter that.

In heavy traffic it is sometimes contended that the only thing the driver sees is the back of the vehicle before him; the experiments showed that it is more usually the case that he is concentrating on trying to see round the vehicle at what is ahead or, if the traffic is moving at a crawl, at other things about him of no significance to his driving. The shape of the vehicle in front of him is memorised and accepted.

Conclusions

It was concluded that it was very difficult to deceive a driver about anything on which he concentrated, or "fixated," his vision, even in poor light. Colour, important by day, becomes less significant by artificial light. Humps in a road present a problem in that they tend to bring the light sources on more distant standards in line with vehicle lights with which they may be confused. The experiments are still incomplete but they are already yielding valuable knowledge which may assist in the re-assessment of the requirements of good road lighting installations in the future.

Discussion

Opening the discussion, Mr G. R. GREIG (Automobile Association) said that the colour of street lighting was very much a matter of opinion. For him, sodium lighting was acceptable, but there were many who found it unpleasant. Uniformity of lighting levels was important but, on long stretches, a change in colour from time to time might alleviate boredom. Where sudden changes of lighting level, such as from Group A to Group B, took place, a transition lamp should be introduced to bridge the change and enable the driver's eye to accommodate itself to the new level. Some authorities had tried the expedient of installing a Class A lamp round the corner where Class B roads joined the main road with advantage; he thought this might be extended. The use of spotlights on pedestrian crossings was also a good practice, which assisted motorists in seeing pedestrians waiting to cross. The effect of lower reflectance surfaces on road lighting was most noticeable, and he thought that co-ordination of the efforts of lighting authorities and those responsible for the road surface was essential.

Mr A. BOEREBOOM (Ministere des Travaux Publics, Belgium) said how happy he was to be able to be present. There were always difficulties in the way of attending overseas conferences but, he was pleased to say, he had received the fullest help and assistance in his country for his attendance at the APLE conference, which should indicate the esteem in which the organisation was held abroad. Commending the author's paper, he emphasised the importance of conducting tests on real roads with normal traffic; tests on experimental roads hardly ever gave the right sort of information. There was need for even closer co-ordination and collaboration between continental and British ideas and activities in road lighting developments. In Belgium, lighting had at last received the recognition of the authorities as to its importance on traffic highways and he had now been granted the finance to relight many miles of roads in Belgium. He thought that there was some need to standardise on road surface brightness levels, but there were difficulties in methods of measuring brightness with any degree of accuracy.

Mr H. R. RUFF (AEI Lamp and Lighting) also referred to the studies on surface brightness. He questioned as to whether there was not a connection between the perception time and the brightness intensity and instanced Davies' experiment with a rotating fluorescent tube at the Faraday Lecture some years back. Mr T. M. CHRISTIE (GEC) said that much of the interpretation of lighting tests depended largely on the degree of expertise of the viewers. Mr H. HEWITT (Atlas Lighting) reminded those present that the problem of glare on the roads was a very different one to that in interior lighting and must be approached in a different manner. It was his view that the surface brightness of the road was of less importance that the avoidance of glare in heavy traffic since the surface was, in any case, largely blanketed by the traffic.

Mr L. R. OSGOOD (Luton) asked the conference to think of the problems of the lighting engineer who was limited in his planning of lighting installations by having to use existing tramway poles as his columns. He also questioned the wisdom of the present practice of designers in planning their fittings with fixed focusing. In the old days of tungsten filament lighting he taught his engineers the difference between focusing which produced a "turnip-shaped" reflection and one which produced a "carrot-shaped" reflection and made them focus their lamps for the latter. With cutoff lighting, proper setting is of the utmost importance. Which was to be the more desired: proper lighting with adjustable cutoff lanterns or fixed-focus lanterns and inadequate lighting?

Councillor J. S. WILSON (Kingston-upon-Hull) asked if roadside advertisements were really necessary on trunk roads, and others also contributed to the discussion. Mr Waldram briefly replied.

Trends in Technology

The paper by Mr J. G. Holmes, A.R.C.S., B.SC., A.M.I.E.E., on "Trends in Technology" was also presented before a well-filled meeting on Thursday afternoon. Tracing the development of electrical lighting sources from the carbon lamp to the 100 lumen/W linear sodium lamp of the present day he showed that, while the cost of everything else had risen considerably, the cost of a lumen hour from commercial lamps had fallen over the past 25 years to one-fifth. This had been due to the efforts of engineer, designer and applied scientist working together. The great improvements in the tungsten lamp alone which had come about in the last decade still made it a valuable unit for public lighting in side streets. Much of these developments had been due to the enclosure of the lamps in smaller glass envelopes and he showed, on a slide, the different forms of envelope shape and size which the 100 W lamp had progressed through in the last few years, finishing

with the latest "mushroom" shape which was now being offered by two makers. One key to this development had been the improved capping cements used, which were now able to withstand the higher temperatures, but this was bringing in its train difficulties in the lampholders where failure of springs and the insulation of the connecting wires was becoming more frequent. There was need for improvement in these accessories. The idea, he thought, in the use of the mushroom lamp was that the longer neck helped to reduce the cap temperatures.

In street lighting, one of the objections to filament lamps was their short life compared with discharge lamps but this could be overcome, if necessary, by under-running; that is, using 250 V lamps on 230 V supplies. This would raise the life to 3,000 hours, increase the power consumption by about 15% and the light output would be 3% up if, for example, a 250 V 200 W lamp were to replace a 230 V 150 W lamp. The pertinent factor, of course, was the labour cost of replacement.

Mr Holmes then briefly traced the development of the gaseous discharge lamps and their position as street lighting sources. Finally, he surveyed materials used in refractor and lantern construction, the design and construction of the lanterns and their supporting columns. In regard to the latter, he made reference to the work which was being carried out by the DSIR on collision hazards with different forms of column material and construction.

Discussion

A number of delegates took part in the ensuing discussion. Dr BALLIN (Atlas Lighting) said that glare wasted light by preventing the road user from utilising the full adaptation of his sight mechanism. This had an important bearing on surface brightness of the light sources. As a source, the present sodium lamp was less bright even than the under-run tungsten filament lamp. The lower brightness came largely from the longer length but length had been a drawback to the use of fluorescent tubes in street lighting on account of the long lanterns they required and it might well be a drawback to the linear sodium lamp. The fittings industry was always ready to experiment with new materials and had used acrylic plastics and aluminium extensively. A lamp had, however, to last 15 to 20 years and the manufacturer had to satisfy himself that the new materials would last this long before committing them to production. Mr J. WILSON described experiments he had made with an under-run 125 W MBF/U lamp on an unorthodox ballast.

The president of the APLE, Mr F. C. Smith, M.B.E., F.C.S., M.Inst.GasE., F.I.E.S. (right) talking with the Mayor of Folkestone, Alderman F. W. Archer, J.P., and Mr V. G. E. Gardner at the APLE exhibition

The PRESIDENT then contributed a short dissertation on the corrosion aspects of fittings and columns. These ranged from the salt-laden atmospheres of seaside resorts to the sulphurous-laden atmospheres of certain industrial centres. Fittings and columns must be treated to resist corrosion under these conditions either by protective coatings, corrosion-resistant surface treatment or other methods; moreover, the treatment must be continuous. Mr D. H. CARRE (Jersey Electrical Co.) supported him by describing wall brackets which had been made by his staff for attachment to granite-faced buildings in Jersey and which had been cadmium plated. After five years in salt-laden winds, they remained in perfect condition. Mr J. PICKUP asked if it was not true that the mushroom bulb, to which Mr Holmes had referred in his paper, had really been designed on the continent for krypton filling?

Progressive Changes

The last of the papers, "Progressive Changes in Public Lighting," was presented by the authors, Mr T. M. Lappin, F.I.E.S., and Mr H. Robertson, GRAD.I.E.E., on Friday morning. This surveyed progress over the past 30 years which had culminated in the present demand for higher levels of lighting. Despite the demand, however, nothing is to be gained by setting higher levels for general purpose roads if lighting authorities cannot afford it. Badly designed installations will not be improved merely by increasing the lumens per 100 ft of road.

The authors then went on to describe lighting practices which had been adopted by the City of Dundee, the Fulham Borough Council, Birmingham Corporation, Glasgow Corporation and other lighting authorities. From these a notable feature was the increasing use of the colour-corrected MBF/U lamps to replace tungsten filament lamps and in places where, a short time ago, the fluorescent tube type of lantern would unhesitatingly have been adopted. A tremendous amount of road lighting activities will be taking place over the next few years and indications are that higher levels of street lighting will continue to dominate the future policies. The ultimate ceiling is unpredictable, though it seems that the cost of electricity may be a determining factor. Despite changes in road surfaces, the principle of silhouette vision is still valid and may well remain so for some time. Higher mounting heights and more efficient light sources are also probable but, in the planning of main road lighting, the needs for satisfactory feeder road lighting must not be overlooked.

Discussion

Opening the discussion, Mr ROBINSON said that he was concerned at the fumbling approach to motorway lighting to date. He was also dubious about using the linear sodium lamp at 35 ft mounting height. Dr J. W. T. WALSH commented that some bodies were inclined to take the view that an engineer was incapable of having aesthetic appreciation. Mr J. R. BRODIE complained that most speakers were referring mainly to motorways and main thoroughfares; little attention was being given to side streets. Mr H. CARPENTER expressed amazement that so little use was being made of fluorescent lighting; surely, residents preferred it to sodium lighting. Mr G. NORMAN queried maintenance figures given in the paper for 250 W MBF/U lamps. The lumen output seemed on the low side and the maintenance costs about 70% high according to his own experience. Mr L. C. RETTIG also queried the figures and asked why lighting engineers could not be called in at an early stage to facilitate the co-ordination of efficiency and appearance. Others also contributed to the discussion.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Peace River—Next Move

Next step towards the fruition of the Peace River power scheme is the application this month by the Peace River Power Development Co. to the Public Utilities Commission for a certificate of public convenience and necessity. The hearing is expected to be controversial, for objection is anticipated from protagonists of public-owned power development—but so far the company has weathered strong opposition. If it is granted the certificate, it will then go to the Provincial Water Rights branch for a licence to permit construction. At the hearing for the certificate it is expected that the Peace River company will present a schedule of power generation costs and may include estimates of Columbia power for comparison. Certainly, officials of the company are still hoping that first construction work, of a pilot or access tunnel, will begin next January. Three 3,000 ft tunnels, each 50 ft in dia, will parallel the access tunnel and be used to divert water from the Peace River during construction of the Portage Mountain dam.

Gatineau Revenue Increase

An increase in total revenue reported by the Gatineau Power Co. for the first six months of this year of 7% brings the total revenue to $9,991,600. Increase in revenue is attributed to greater demand for electricity and to the sale of excess power made possible by the excellent water conditions which prevailed during the first half of the year.

The company has received a total of $10,243,143 from the Brunswick Power Commission, a large amount of which represents compensation admitted in respect of the company's properties expropriated. The company are at present taking steps to have their claim for an increase in this compensation heard. It is claimed that compensation should be considerably in excess of the amount admitted by the Commission.

U.S.A.

Electronic Future?

The forecast that by 1965 electronic controls that permit a person to brighten or dim the house lights from his easy chair will be priced low enough for almost everybody, was made recently by Mr L. B. Davis, general manager of the Electronics Components Division, GE of America. Such controls now cost about $150 but in five years their price would be down to $10 or $12, he declared. Also off the drawing boards and ready for production are electronic devices that permit locking of house doors from an occupant's bed and controls that automatically shut windows when it rains and reopens them when the sun appears. But the first non-entertainment home item to go into mass production will be the electronic cooking range, which takes only a fraction of the time of conventional ranges to cook food, he asserted. The electronic range is now in limited production by several manufacturers for hotels and restaurants and cost over $1,000, but by 1963 the price will be down to $250 to $300, the level at which gas and electric ranges are selling.

Circuit-breaker Order

Delivery has started this month of the 365 oil circuit-breakers, rated at 150 MVA at 7,200 V, ordered by the Los Angeles Electricity Department from South Wales Switchgear Ltd. The contract was worth nearly £250,000. The equipment has been designed to meet American standards and the Los Angeles authorities have conducted field tests on it. Delivery is scheduled to be completed by next spring. Most of the breakers are to be housed in concrete cells, but for others, South Wales Switchgear are providing outdoor housings giving full weather-proof protection.

RUSSIA

Bratsk Change

The first section of the Bratsk hydro-electric station, now being built on the River Angara, Siberia, will go into service next year and not in 1963 as originally planned. The design of the dam across the river has been improved, making it possible to start flooding the reservoir and to obtain the designed pressure much earlier. Total expenditure on the project will be cut by 2,900 million roubles and the specific capital investments per kWh of guaranteed power output will accordingly be considerably reduced, we understand.

W. GERMANY

Locos Ordered

Contracts for 342 electric locomotives worth DM390 million (over £33 million) have been placed by the Federal German Railways. The locos are to be built by Krauss-Maffai, Henschel, and Krupp, with the electrical power equipment provided by Siemens, AEG and Brown Boveri. Delivery is to begin about the middle of 1961 and be completed in 1964.

S. AFRICA

Pretoria Orders

Pretoria City Council have approved the acceptance of tenders from British or British-controlled firms for certain auxiliary plant for the first section of its new power station now under construction at Rooiwal, 15 miles to the north of the city. The tender of W. H. Allen, Sons and Co. Ltd., amounting to £104,751, has been accepted for the circulating water pumps and equipment: that of English Electric Co. (SA) Ltd., amounting to £155,234 for 3,000 V and 415 V switchgear and accessories, and that of Babcock and Wilcox of Africa Ltd., amounting to £71,543, for the ash and dust-handling equipment. The main generating plant is being supplied by English Electric Co. (two 60 MW turbo-alternators) and Yarrow (Africa) Ltd. (two 550 klb/hr boilers), their tenders having already been accepted. The first section of the Rooiwal station is programmed to go into commercial operation before the winter of 1963, and the estimated cost of this section is placed at £9,500,000.

INDIA

Rihand Project

The first of six English Electric 50 MW turbo-generators of the Rihand power house in Uttar Pradesh will have its trials next February. The entire project is scheduled for completion four months later. Nearly 600 miles of transmission line will connect the Rihand grid to central and western Uttar Pradesh and another 500 miles of lines to the eastern district. The project includes a 270 ft high dam across the River Sone, near Pipri, forming a 375,000 million cu ft lake.

Kanpur's Expansion

With total outstanding demands for electricity reaching 70 MW, the Kanpur Electricity Supply Administration is faced with a difficult task, in view of the foreign exchange position. A 15 MW generating set, originally proposed early in 1958, is expected to be in operation in 1962 and an existing 15 MW set and two 150 klb/hr boilers are being replaced because of age, and a major thermal power station is proposed to be set up in Kanpur during the third Five-year Plan. During the year ended 31 March, 1960, some 8,574 kW of load was connected to the Administration's system, and the maximum demand reached 54,225 kW. Total units generated in the 12 months amounted to 277½ million.

PAKISTAN

Control Centre

The West Pakistan Water and Power Development Authority are to establish a major control centre outside Lyallpur to control the power stations and grid network throughout West Pakistan. Telemetering and indication equipment is also to be installed in the power stations and substations to provide information for the centre which will also be able to control the operation of plant at the distant stations.

Multi-purpose Project

The consultants' planning report on the proposed Tarbela Dam project is expected to be in the hands of the West Pakistan Water and Power Development Authority next month. A reservoir of 6,000,000 acre ft, to be built under the project, when completed will feed some of the link canals which are at present fed by the three eastern rivers whose supply is likely to go over to India under the proposed canal waters treaty. The potential of the dam, according to the recent investigations by WAPDA consultants, has increased by 1,800,000 acre ft over the 4,200,000 acre ft previously estimated during the general survey of water resources in West Pakistan in 1953-54. Similarly, the power potential of the dam has also been raised from 6,000 kW to 1,100,000 kW. The dam will be 10,000 ft in length and 370 ft in height. According to the present indications, construction on the seven-year project will start early in 1962. The project will incur Rs 1,000 million worth of foreign exchange. It is proposed to develop only irrigation potential in the beginning, but power turbines will be put in as and when the load develops.

Hill Tracts Scheme

A hydro-electric scheme to be constructed on the River Sangu, near Bunderban, some 65 miles from Chittagong, has been proposed. According to the plan, the station would have a capacity of about 100 MW and provide a firm output of 30MW. A preliminary investigation, now under way, has been reported as very encouraging. The final survey of the project is likely to start from October next. Construction work on the Sangu project is likely to start after the completion of the first Hill Tracts project—the Kaptai project—in 1965. It may be recalled that the third 40,000 kW unit of the Kaptai project is expected to be completed by 1965. The International Engineering Co. of America, who are the consulting engineers for the Kaptai project, are at present examining the scheme and the prospects of the Sangu River power project. The company is likely to be engaged as the consulting engineers for the Sangu project as well. But it is learnt that unlike the Kaptai project, where an American firm has been entrusted with the construction work, no foreign firm will be given any contract work. Instead, Pakistan engineers may carry out the civil engineering work.

AUSTRALIA

Full Load

The Liapootah power station of the Hydro-Electric Commission of Tasmania is now in full operation with its three machines totalling 83,700 kW. It is the tenth station in the Commission's hydro-electric system, raising the aggregate capacity to 569,000 kW. The project has one of the largest steel-drum gates in the world at the Liapootah dam.

Six Sets Running

The Wangi power station of the New South Wales Electricity Commission has been raised to its full capacity with the putting into service of the last of six turbo-generators. There are three 50 MW sets and three 60 MW machines. The station, which operates as base load, consumes almost the entire output of Awaba State coal mine and a large proportion of Newstan's colliery production.

NEW ZEALAND

Wairakei Plant

Bennis Thermoflash Ltd., of Manchester, have been awarded a £150,000 contract for a flash steam plant to be installed at the Wairakei geothermal power project, New Zealand. This is for the pilot hot-water scheme which is being constructed between stages 1 and 2 of the power project. In this, hot water from the geothermal bores will be "flashed" and fed to i.p. and l.p. turbo-generators with an aggregate installed capacity of 190 MW.

Hutt Valley Report

Operations of the Hutt Valley Electric Power and Gas Board, New Zealand, in the year ended 31 March last resulted in a surplus of £11,848 after providing for capital works—an improvement on the previous year when there was a deficit of £74,993. A further 1,969 new connections were made, of which 536 were all-electric State houses and 1,295 private installations. Sales to domestic consumers provided £835,870 out of a total revenue of £1,674,734, average domestic consumption reaching 7,414 units for the year. Over 71% of consumers have electric cookers, yet a further 2,060 were installed in the year together with 2,098 new water heaters. Work on the installation of load control relays is progressing well.

KOREA

Thermal Plant

Site investigation is currently under way on a proposed new 30,000 kW power plant for the Kunsan, Korea, area. Burns and Roe Inc., New York City engineers and constructors, are now studying local fuel and water resources, with a view to deciding the exact location and design of the plant. A tentative selection has been made on the outskirts of Kunsan, located along the south-west coast of Korea, approximately 140 miles south of Seoul. Construction is expected to begin in the spring of 1961 and the station is expected to be in operation later in 1962. Financed by the International Co-operation Administration (ICA) the plant will be built for Korea Electric Power Co.

JAPAN

Another Nuclear Project

What will be Japan's first nuclear power plant, if it is in operation early in 1963 as planned, is to be imported from the United States. It will be erected at Tokai-Mura. The Japan Atomic Energy Research Institute has agreed with the GE of America to sign a contract for the purchase of a boiling-water type experimental power reactor. Talks on the purchase deal were delayed by the insistence of GE officials of an escape clause to free the company from responsibility in case of accidents occurring after the reactor is delivered. The situation was cleared up when General Electric consented to sign a conditional contract empowering it to call off the installation of the reactor if Japan failed to introduce an atomic energy accident compensation law within two years after the start of installation work. Although the US reactor is an experimental model with thermal power capacity of 12,500 kW, as compared with the far larger British equivalent capable of producing 166,000 kW, it will be the first in Japan to generate electricity on a practical basis. By early 1963 it is scheduled to start supplying power to part of the grid of the Tokyo Electric Power Co. The Japanese Institute will start building a concrete housing for the reactor, which will be jointly installed by General Electric and two Japanese electrical industry groups. Price of the reactor and expenses for its installation are estimated at a total of Y4,400 million. The reactor is also expected to be utilised for studies on nuclear-powered ships which Japan hopes to build in the near future.

Personalities *in the industry*

Mr A. Abbott

Mr J. V. Cox

Mr H. Stanesby

Mr J. T. Jolley

Mr P. J. Lawson

Mr A. Abbott, M.I.E.E., is joining the head office staff of Foster-Wheeler Ltd. as chief electrical engineer (Process Plant Division). He joined the central engineering establishment of the NCB in 1958 as head of electrical engineering development, after serving for ten years as senior assistant technical engineer with the CEGB (Southern Division). After serving his training at Ferranti Ltd. and Ferguson Pailin Ltd. he served in turn with Manchester Corporation Electricity Dept., the GE Co., Witton, and Merz and McLellan at their Newcastle office. During the period 1948-52 he was honorary secretary, IEE Southern Centre.

The Eastern Electricity Board have appointed **Mr J. V. Cox,** A.M.I.E.E., at present senior assistant engineer (planning and development) at Chilterns sub-area, to be the senior assistant engineer in the development section at area headquarters in the place of **Mr H. E. Judd.** Mr Cox received his technical training at the Leeds College of Technology and entered the industry as a student engineer with the Leeds Corporation. He later joined the Letchworth supply undertaking as a control engineer in the generating station and was promoted personal assistant to the engineering manager. In 1948 Mr Cox joined the Northmet sub-area of the Eastern Electricity Board as second assistant engineer engaged on planning and development, moving later to a similar position with the Chilterns sub-area.

Mr H. Sammons, C.B.E., is to retire from the position of managing director of D. Napier and Son Ltd. at the end of this year. He has been with the company since 1942. **Mr H. E. C. deChassiron,** C.B.E., has been elected to the board of Napiers and has been appointed managing director designate. He will succeed Mr Sammons as managing director on 1 Jan., 1961. Mr de Chassiron joined the English Electric Co. Ltd., the parent company, in 1958 and is at present assistant to the general manager of their Rugby works. It is also announced that **Mr P. J. Daglish,** B.SC., M.I.MECH.E., M.I.E.E., A.F.R.AE.S., has this month been appointed special executive responsible to the managing director of D. Napier and Son. Previously he was manager of the English Electric Co.'s Aircraft Equipment Division at Bradford. In this post he has been responsible for the establishment of the Division which is now providing a wide range of equipment for aircraft being built in Europe and the USA. During this time the Division has introduced into Britain the use of constant frequency a.c. electrical systems in aircraft. Mr Daglish joined the English Electric Steam Turbine Department at Rugby in 1946. In 1948 he was appointed manager of the company's Standards and Specifications Section. The following year he became deputy chief development engineer and, in 1950, was appointed assistant to the chief engineer.

Mr H. Stanesby, C.G.I.A., M.I.E.E., has been appointed Deputy Director of Research at the Post Office. He is at present staff engineer in the Radio Planning and Provision Branch of the GPO Engineering Department. Mr Stanesby's early career was spent in the radio laboratories at Dollis Hill, which he entered as a youth in training in 1924. He was intimately concerned with the development of the first long-wave transatlantic radio telephone system, and with radio receivers for long-distance communications. Later he played an important part in developing coaxial cable systems for multi-channel telephony. In this connection he made valuable contributions to the art of quartz-crystal filter design, which were brought to practical fruition in the first London-Birmingham multi-channel telephony coaxial cable system. In 1951 Mr Stanesby took charge of the Radio Laboratories at Dollis Hill, and in 1952 became responsible for the Radio Planning and Provision Branch of the Engineering Department, being actively concerned in the design of the new radio station at Rugby opened a few years ago. He was chairman of the IEE Radio and Telecommunications Section in 1955-56.

Mr A. D. Sheridan has been appointed a director of British Physical Laboratories, where he remains in charge of the Export Division.

Mr R. H. Weir, Director-General of Engine Research and Development, has been appointed Director of the National Gas Turbine Establishment at Pyestock, in succession to **Mr H. Constant,** F.R.S., the Ministry of Aviation announce.

Further appointments have been made in the sales force of ECC (Moulded Breakers) Ltd. **Mr N. G. O'Hara** has assumed the responsibility of London and southern area sales manager, supervising the areas at present covered by London, Bristol and Cardiff offices. **Mr J. T. Jolley** has joined the company as northern area sales manager, responsible for the territory covered by Manchester, Leeds and Newcastle offices. Mr Jolley served his apprenticeship with the Chester Corporation Electricity Department, now incorporated in MANWEB. Following four years' aircraft industry service during the war, he joined Cantie Switches Ltd., initially in charge of estimating and subsequently of the Newcastle and Manchester area offices. He later became sales engineer with Whipp and Bourne Ltd., a position he has vacated to join ECC (Moulded Breakers) Ltd.

Mr E. W. Woolcott, F.I.A.C., has been appointed to the board of Landis and Gyr Ltd. He joined that company in 1931, became chief accountant in 1935 and has been financial manager since 1947.

Mr P. J. Lawson, A.M.I.E.E., has been appointed to the board of Vactric (Control Equipment) Ltd.

Former chairman of the North of Scotland Hydro-Electric Board, **Mr Thomas Johnston** has accepted an invitation to join the board of the company to be formed to provide programmes for the Independent Television Authority in North East Scotland.

For many years manager of the Manchester branch of Bill Switchgear Ltd. **Mr H. H. Pollard** is shortly to retire. His successor is **Mr J. Ballentine** who has been with the company for many years and was previously area branch manager at Belfast. The new Belfast manager is **Mr R. A. Simpson,** who is well known in the electrical trade and was previously with Temco Ltd.

Mr W. H. Yates, F.C.A., has been appointed company secretary of Bill Switchgear Ltd. He qualified with the Institute of Chartered Accountants in 1948 whilst serving with Wright and Westhead, of Stafford.

Having reached normal retiring age, **Mr W. T. James,** O.B.E., will be retiring from the board of British Electric Traction Co. at the end of this year.

Mr A. H. Collyer is relinquishing his appointment as advertising manager of the Morphy-Richards group in order to take up promotional duties with one of the Morphy-Richards subsidiary companies. He is succeeded by **Mr C. R. St. Quintin,** who has joined the group from Celotex Ltd. where he was advertising manager. Previously he was publicity manager of the Radio and Television Division of Philips Electrical Ltd.

Dr R. L. Smith-Rose, C.B.E., D.S.C., PH.D., M.I.E.E., was last week elected president of the International Scientific Radio Union at the final plenary session in London.

Changes in the board of British Insulated Callender's Cables Ltd., effective from 19 Sept., are announced. **Mr H. F. Akehurst,** B.SC., A.M.I.E.E., previously director (overseas operations), **Mr R. M. Fairfield,** B.SC.(ENG.), M.I.E.E., M.I.MECH.E., FEL.A.I.E.E., formerly director (home operations) and **Mr W. C. Handley,** B.SC.(TECH.), M.I.E.E., previously director (home group co-ordination) become assistant managing directors of the company. They will be responsible to Sir William McFadzean, the managing director, for the day-to-day operation and administration of the company in their respective spheres. In addition, **Mr E. Bowyer,** J.P., B.SC.(TECH.), M.I.E.E., A.M.I.MECH.E., and **Mr C. H. Broughton Pipkin,** A.M.I.MECH.E., M.I.E.E., are appointed executive directors. **Lt-Gen Sir Ronald M. Scobie,** K.C.B., C.B., M.C., who has been a director since Sept., 1947, has resigned. Mr Bowyer, who is also a director of British Copper Refiners Ltd., BICC-Burndy Ltd. and Electric Transmission Ltd., has been general manager (Prescot) since Dec., 1958. He received practical training with Callender's Cable and Construction Co. which he joined in 1931. After occupying the senior positions of production manager at Leigh, and manager of the Rubber and Thermoplastic Cables Production Division at Leigh, he became assistant manager, production, in 1948, and in the following year was promoted to manager (production) of the whole company. In 1955 he was appointed general works manager. Mr Pipkin, who isal so a director of British Copper Refiners Ltd., United Telephone Cables Ltd., and Southern United Telephone Cables Ltd., also served with the old Callender's Company. After war service he returned to BICC in March, 1946, as personal assistant to one of the managing directors, became manager (special business arrangements) in 1948, and manager (home sales) in 1952. He was appointed commercial manager (home) in 1958.

Among the various Scottish Electrical Societies, which have resumed activities for the session, **Mr J. Rintoul,** of Bo'ness, has been elected president of the Falkirk and District Electrical Society, with **Mr M. Dick,** of Bonnybridge, as vice-president. New president of the Edinburgh Electrical Society is **Mr James C. Adam,** and vice-president is **Mr I. D. Stuart.** The Electrical Society of Glasgow has **Mr R. Russell** as president, and **Mr W. H. Vipond** as vice-president for the year.

New appointments in the Electrical Appliance Division of Charles Colston Ltd. are announced. **Mr Paul W. Roberts** has been promoted to assistant to the group service manager, and **Mr R. A. Hughes** has been transferred from the Tallent (Minibrix Division) to become area manager in the Northern Ireland district. Two district dealer liaison managers have been appointed in the Southern branch, **Mr W. L. Winston** (Eastern district) and **Mr N. J. Morris,** formerly branch contracts manager (London district). There are two similar appointments in the Northern branch, **Mr J. Ibbotson** (North Western district) and **Mr W. Ratcliffe** (Merseyside and N. Wales district).

Formerly secretary and chief public relations officer to London Transport, **Mr R. M. Robbins** has now been appointed chief commercial and public relations officer as from this week.

Mr J. Ballentine

Mr R. A. Simpson

Mr W. H. Yates

OBITUARY

Mr F. L. Poyser, B.SC., A.M.I.E.E., head of the Engineering Department of the North West Wiltshire Area College for Further Education, has died aged 48.

Mr G. L. H. Brough, C.B.E., B.SC., M.I.E.E., formerly deputy director, electrical engineering, Admiralty, died on 13 Sept., aged 70.

Mr H. K. Squires, advertising manager of Hoover Ltd., died on 10 Sept., aged 43.

The electrical industry has lost one of its most distinguished pioneers by the death on 14 Sept. of **Sir Arthur Fleming,** C.B.E., M.SC.TECH., LL.D., D.ENG., F.C.G.I., HON.M.I.E.E., M.I.MECH.E., F.INST.P., at the age of 79. He was primarily noted as one of the pioneers of broadcasting—the transmitting station established at Trafford Park was the second in the country to send out daily programmes—for his research work generally and as "father" of modern engineering training. Numerous learned institutions honoured him for his work on research, but it was for his services to education that he received a knighthood in 1945. Born at Newport, Isle of Wight (only a few miles from Luccombe, where he died), he studied at Finsbury Technical College and, after gaining further experience at the Westinghouse Wks, East Pittsburgh (USA), he joined the technical staff of the British Westinghouse Co. (subsequently Metropolitan-Vickers) in 1902, where he was Director of Research and Education, continuing in that capacity with AEI during the greater part of his 51 years' service until retiring in 1955. It was in 1919 that he greatly expanded the recruitment of university graduates as college apprentices, introducing a year's practical experience into the course. The outstanding work of the research laboratories under Sir Arthur Fleming's direction has included research in dielectrics, high-voltage phenomena, creep of metals at high temperatures and pressures, the discovery of low-pressure oils and greases and the development of continuously evacuated plant and apparatus. On the education side, he had for many years supervised the education and training of all grades of the Metrovick apprentices. President of the IEE in 1938, Sir Arthur read many papers before the Institution. His Faraday Lecture in 1937 was on the "Evolution of Electrical Power" and he was awarded the Faraday Medal in 1941.

Sir Arthur Fleming

Goods handling by "Robotugs"

ABOUT two years ago British Railways and EMI Electronics Ltd. embarked upon a study of the automatic handling of goods by "Robotugs," a device which had been developed by the latter company, and two of these were installed for a trial experiment at Newton Abbot goods shed. As a result of the experience gained during that period a full-scale installation, comprising five "Robotugs" and the associated leader cables and equipment, is now in continuous operation from 6 a.m. daily at the Herbert St, Wolverhampton, goods station of BR, Western Region.

The "Robotug" System

The "Robotug" is an unmanned battery-driven traction unit for hauling goods trolleys along the concreted passageways of the goods yard without rails or visible means of guidance or control. In fact, the guiding influence is a leader cable buried below the concrete carrying a small a.c. current which is sensed by two coils mounted under the "Robotug." So long as the vehicle is on course, the currents induced in the coils are equal and balance out. Any deviation from the course biases the induced current flow to one or other of the coils which is used to control a steering motor to bring the vehicle back on course. Should the current in the leader cable fail, or the vehicle wander so far off course as to take it out of the influence of the a.c. field, starter relays on the vehicle will operate to stop the motors and apply the brakes. A safety bumper in front of the tug also operates the stopping mechanism, and since the speed of the "Robotug" is only 2 m.p.h. little or no harm can come to anything with which it comes into contact.

The system also has a programming facility by which the "Robotugs" can be dispatched to any one of a number of stations at will by merely pressing switches on the vehicle at the moment of dispatch. This facility includes the sectionalising of the leader cable which, like the railway systems, maintains a dead section between adjacent "Robotug" trains. Count coils buried in the floor and energised from the track circuit influence the counting circuits on the vehicles as they pass enabling the programme unit to be kept informed of the position of the vehicle and so bring it to a stop at the required station. The system is completely automatic and is inherently safe. Any fault, either in the vehicle or leader cable system, immediately brings the line to a standstill. Driver or pedestrian control, the latter by a walking-stick type of tiller fitted into the steering pillar, can also be used to move the vehicle and trains.

At Wolverhampton the inwards sundries traffic fills 48 wagons at the start of each working day and at present some 86 wagons are discharged by the system to vans for delivery by road in the borough and surrounding districts in a normal working day. The aim of the scheme has been to enable a greater tonnage of goods to be handled with less manual effort, and the savings in labour costs are estimated to recover the capital outlay and running charges of the equipment in a few months. The system is sufficiently flexible to be readily adjusted and organised to meet considerable fluctuations in traffic, and operatives welcome the lesser handling and walking about that has resulted from its installation.

NEW LITERATURE

The Tramways of Huddersfield

by Roy Brook

IT is a significant aspect of the present rate of progress that the electric tramway as a means of public transport has only enjoyed a life of barely half a century. During that period, however, it has managed to gain a large number of supporters who have viewed its demise as premature. These will find in this book a fascinating history of one undertaking which has progressed from horse, via steam, to electricity—and extinction—in its tramway system over only 57 years. The electric period spanned 38 years from 1902 to 1940; by contrast, steam trams existed for 20 years, from 1883 to 1902, and horse trams from 1877 to 1883. Tram lovers should get a copy before it is out of print, particularly as the profits are to be donated to the Tramways Museum Society. Published by The Advertiser Press, Huddersfield, price 10s. 120 pages, 8½ in. by 5½ in., with photographs and map.

A First Course in Wireless

by "Decibel"

IT is nearly 25 years ago since the first edition of this useful little book for the beginner was compiled on the basis of a series of articles in *World Radio* under the title "The Radio Circle: For Beginners Only." Written for the amateur who was then largely concerned with constructing his own set, it proved a valuable and informative volume which must have helped hundreds on their way to becoming radio and, subsequently, electronic engineers. In those days there was no television, no transistors and only a very few were acquainted with the modern concepts of electron theory. By comparison with today, life for the radio enthusiast was simple. In four editions and a number of reprints the author has managed to keep the reader up to date with progress, albeit he has not attempted to include television in the coverage. The latest edition has a new chapter on the more recent developments in crystal diodes and transistors; otherwise, the formula is much as before. Published by Sir Isaac Pitman and Sons, 4th Edition, price 12s 6d. 241 pages, 7¼ in. by 4¾ in. 98 illustrations.

The Arc Discharge

by H. de B. Knight,
M.SC., M.I.E.E., F.INST.P.

THERMIONIC valves may be divided into three broad classifications according to the type of gas discharge by which they operate. These types are the Townshend discharge, an early stage in the ionisation process which is utilised in the gas-filled photo-electric cell and similar devices, the Glow discharge, a luminous stage of ionisation in which primary electron emission is stimulated by the presence of low work function material coatings on the cathode and/or by heating; and the Arc discharge in which ionisation of the gas is maintained by heat generated in the arc itself. Glow discharge forms the basis of design of low current, high voltage valves of the type uesd in radio and allied circuits. Arc discharges, which are self-maintaining, form the basis of the high current rectifying devices, thyratrons and ignitrons.

This volume is confined to a study of the latter devices and opens with a concise but comprehensive description of the general principles which govern valve operation and the characteristics of the various forms of valve. The physical processes in their operation, the related circuits and components are then discussed.

The author has devoted practically the whole of his industrial career to the study of the subject and he writes with clarity and an economy of words which will be welcomed by the practical designer and student alike. The book is copiously illustrated and is not overburdened with mathematical formulae. Published by Chapman and Hall, price 63s. 435 pages, 8½ in. by 5¼ in.

Direct Current Electricity

by Alexander Efron

ONE of a series of paper-backed basic science primers for junior grade students and artisans wishing to acquire basic knowledge of scientific matters in the USA, this is devoted to a description of the fundamentals of d.c. technology in a most elementary form. For its coverage, presentation and size, it seems a little over-priced in the UK. Published by Chapman and Hall, price 18s. 89 pages, 8½ in. by 5½ in.

U.S. gas-cooled reactors

HELIUM COOLING FOR ADVANCED DESIGNS

AMERICAN interest in gas-cooling for nuclear reactors is growing, and two of the papers at the recent International Atomic Energy Agency Conference described in detail designs being developed by the General Atomic Division of General Dynamics Corporation. One of the important differences between the American approach in this field and current British techniques is that the Americans incline to use helium as the coolant rather than the British carbon dioxide. Amongst advantages resulting are chemical inertness and easier pumping.

The two reactors described both use enriched uranium fuel and aim at producing gas outlet temperatures of 1,300°F and above. The more interesting (HTGR) is a 40 MW electrical output reactor being built for the Philadelphia Electric Company's power system at Peach Bottom. The core of this reactor is a close-packed nest of 855 cylindrical fuel elements, 3½ in. diameter by 12 ft long. There are coolant passages between the elements and the length of the core is 7 ft 6 in. (not including top and bottom reflectors) and the diameter is 9 ft. The fuel elements, described in more detail later, consist of U 235 and Th 232 in the form of carbides dispersed in a graphite matrix. (In some ways like the intended Dragon reactor, see page 431.) This construction gives large mechanically strong fuel elements which have an effectively large heat transfer surface without the need for fins. With helium at about 300 lb/sq in. pressure, core power densities of the order 10 kW/litre are possible with a pumping power in the core equivalent to only about 1% of reactor heat output.

Reactor Core

The reactor core is contained at the lower end of a cylindrical pressure vessel so arranged that the seal is subjected only to the temperature of the reactor inlet gas, about 660°F. The coolant gas enters the reactor along the outer annulus of a concentric pipe system, along passages formed by the thermal shield and the pressure vessel wall and through the side reflector before it passes up the reactor core. The refuelling is carried out from the top of the reactor through a single fuel-rod machine. Control rods operate upwards from the bottom of the reactor. Fuel changing has to take place with the reactor shut down and with the coolant pressure reduced to slightly below atmospheric.

The fuel elements consist of a graphite sleeve containing the compact of uranium and thorium carbide and graphite. The composition of these compacts is such that there is about one atom of U 235 to ten atoms of thorium to 700 atoms of carbon. Surrounding the compacts are highly, though not completely, impermeable graphite cans. Streams of coolant come between the graphite cans and the fuel compacts and are extracted at the bottom supports. Any fission products escaping from the single cans are taken by this means to an external tripping system.

It is claimed that whereas with natural uranium reactors the problem is to reduce loss of neutrons in the non-fissionable U 238, with an enriched system this consideration is not pressing. As a consequence, there is not the same need to have a low surface-to-volume ratio as represented by round rods, pitched in a relatively widely spaced lattice in the moderator. Operating at high temperatures, however, fins are not very practicable. An alternative way of increasing effective core heat transformer surface is to include the moderator within the fuel elements. In the HTGR, use is made of the good thermal conductivity of graphite to transfer heat from the fuel particles to a large surface.

High Temperature Advantages

The high temperatures possible are important not so much as permitting higher thermal efficiency as for their influence in reducing capital cost. Large and expensive heat exchangers and dual-pressure systems on the same side are unnecessary. With HTGR, reactor outlet gas temperatures of about 1,380°F are envisaged, with steam at 1,450 lb/sq in., 1,000°F. This makes possible thermal efficiencies of about 40% without resort to reheat or dual-pressure cycles. Another advantage of the design is claimed to be relatively small distortion of the fuel elements, since a burn-up of as much as 50,000 MW-days per ton of fissile and fertile material calls for only 0·1% destruction of fuel element atoms.

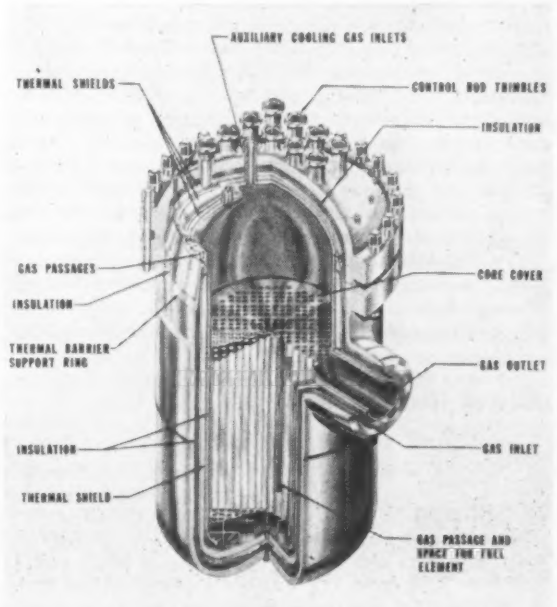


Fig. 1. Details of helium-cooled marine type reactor to drive a gas-turbine alternator, described on the next page

The manufacturers expect that HTGR designs will prove economic in the size range 150 to 300 MW, although there will be extensive application in the 40 to 100 MW range.

Marine Reactor

The second reactor described is a modification of a maritime gas-cooled reactor (MGCR) being built for ship propulsion. Its nuclear interest lies in the use of beryllium oxide as a moderator, but the greater interest is the intention of operating the reactor in conjunction with a gas turbine. As at present envisaged with an output equivalent to 23 MW electrical, the reactor uses uranium oxide fuel in metal-clad cans. The initial design is for 1,150 lb/sq in. gas pressure, 1,300°F outlet temperature, but the design provides for substantially higher temperatures. General arrangement of the reactor is shown in Fig. 1. Although carbon dioxide might have been used as the coolant for temperatures up to 1,300°F, at higher temperatures it becomes sufficiently chemically reactive to rule out some of the refractory metals which hold promise as cladding materials.

MGCR is reckoned to be particularly suitable to small-output applications, when used in conjunction with a gas turbine. In the complete plant envisaged, compressed helium leaves the h.p. compressor and passes through a regenerator, where it is heated to about 750°F. It then enters the reactor, emerging at 1,300°F. The reactor outlet gas passes through an h.p. turbine, which drives the compressors of the gas-turbine set, then through the low pressure turbine, which provides the output power. The exhaust from the low pressure turbine passes through the hot side of the regenerator, where it gives up its heat to the gas entering the reactor, and it is pre-cooled before being partially compressed in the low pressure compressor, again cooled, and entering the high pressure compressor to complete the cycle.

Helium in Gas Turbines

Helium has characteristics that affect design of gas turbines. It is best used with small volume change as it flows through the machine, and it needs a large number of stages. The authors of the papers sum up the case thus: helium makes aerodynamics simpler but mechanical design more difficult than the heavier gases.

O.C.B's FOR INDUSTRY

REQUIREMENTS for medium-voltage oil circuit-breakers are set out in a thorough revision of BS 936, previously existing as a war emergency standard. The revision brings this standard in line with other switchgear standards, such as BS 116, which deals with oil circuit-breakers generally. The principal changes made concern details of the clauses covering making capacity, breaking capacity and short-time current tests, which are laid down in considerably more detail than in the previous edition.

The standard sets out fully the conditions for which breakers complying with it are assumed to be suitable for service. Three-phase systems are assumed, but without restriction as to whether the neutral point is earthed or insulated. An ambient temperature not exceeding 40°C peak and having an average value not over 35°C, taking a 24-hour period, is specified. The altitude should not exceed 3,300 ft above sea level and the atmosphere should not be subject to excessive pollution as, for example, with smoke, chemical fumes or salt-laden spray. Operation is for a B-3-MB short-circuit duty, with a power factor under short-circuit conditions not less than 0·3 lagging. The circuit-breaker is to be filled with oil, complying with BS 148: Insulating oil for transformers and switchgear.

Altered Ratings

Short-circuit ratings have been changed so that the currents correspond to 415 V instead of 440 V and 600 V instead of 660 V. Additional rated currents have been included, ranging down to 20 A for the lowest MVA rating and up to 3,000 A for the highest rating. Standard breaking capacity ratings now range from 0·52 to 31 MVA at 415 V and from 0·75 to 45 MVA at 600 V. Another new feature is provision of standard ratings for circuit-breakers in flameproof enclosures. Here the range is from 2·6 to 10·4 MVA at 415 V and 3·75 to 15 MVA at 600 V. FLP circuit-breakers have current ratings in general from 150 A to 400 A.

Preferred normal currents of series-trip coils are in addition to the standard, values up to 1,000A being listed. It is reckoned that at higher currents series-trip coils are likely to have single-turn windings, so that the rated normal current is the same as that of the circuit-breaker.

The standard is intended to apply to three-pole o.c.b's which are suitable for three-phase industrial and supply distribution systems where there is an appreciable resistive component in the short-circuit impedance, so that marked asymmetry in the short-circuit current cannot occur. Test power factor is 0·3, as against the maximum of 0·15 for some circuit-breakers to BS 116. The short-circuit test duties are three in number, B-3-MB at 30% rated breaking capacity; B-3-MB at 100% rated breaking capacity and 100% rated making capacity; and a short-time current test with the breaker in the closed position. Acceptable behaviour of the circuit-breaker during and after proving tests is defined in considerable detail.

User Guide

Besides serving the usual purpose of defining acceptance tests on circuit-breakers, the standard offers extensive guidance on selection of o.c.b's on incidental calculations. Appendices discuss special application conditions and selection related to fault conditions and shows how short-circuit currents should be calculated. In this respect there is emphasis on the need to take account of resistance as well as impedance of cables and busbars feeding the potential point at fault.

The foreword to the standard includes a warning that some time must elapse before circuit-breakers are available complying in all respects with the revised standard. It is suggested that in the meantime application of the 1960 revision in place of the 1940 edition should be subject to mutual agreement between contracting parties.

E.R.A. Reorganises

REORGANISATION of the committee structure of the Electrical Research Association, which has been under consideration for some time, is now nearing completion; the chairmen of the new divisional committees have been appointed and the new organisation is planned to become fully effective next year.

Hitherto, the work of the Association has hinged round the sectional committees, each concerned with a broad field of research and representative of sections of industry interested. Their function was largely advisory and supervisory of the sub-committees set up by them to carry out executive functions in connection with researches approved by the council. In all, there are 20 sectional committees, supported by 90 sub-committees, and it was felt that a reduction in the number of channels of communication would enable the allocation of available funds to be concentrated on subjects falling within a reasonable number of broad categories. It was also hoped to ensure greater fluidity of programmes and the speeding up of disclosure of results.

Six Research Divisions

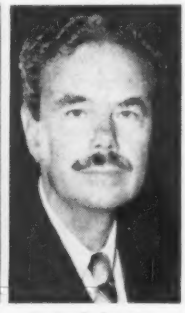
In the new structure, the 20 sectional committees will be replaced by six divisional committees appointed by the council from senior engineers. The divisions are listed below, together with the first chairmen.

NEW ERA DIVISIONAL COMMITTEES AND FIRST CHAIRMEN

1: **Insulation:** Dr L. G. Brazier, director of research, British Insulated Callender's Cables Ltd.
2: **Generating Plant:** Mr E. S. Booth, member, Central Electricity Generating Board.
3: **Power Supply Transformers, Switchgear, etc.:** Mr J. Christie, technical director, A. Reyrolle.
4: **Power Supply Lines and Cables:** Mr S. E. Goodall, director of engineering, AEI (Woolwich) Ltd.
5: **Equipment—Light:** Mr A. N. Irens, chairman, South Western EB.
6: **Equipment—Heavy:** Mr H. M. Mathews, director of engineering, English Electric.

Mr A. N. Irens

Mr J. Christie



Dr L. G. Brazier

Informal meeting of three of the new chairmen; from left, Mr E. S. Booth, Mr S. E. Goodall and Mr H. M. Mathews

The precise scope of the divisions is now under discussion but their responsibility will be to advise the council on work to be undertaken and broadly supervise both general and detailed research programmes in their own fields. Responsibility for preparing the detailed research programmes, however, rests with the director.

To assist the director in planning detailed programmes, research advisory committees will be appointed by each divisional committee, the members and chairmen being chosen in consultation with the director. They will be drawn largely from the staffs of members who will use the results of the research, or those able to provide special information; scientists and engineers from universities or elsewhere will also be invited to serve.

It is emphasised that the work of these research committees is in no sense to direct the work of the laboratories; it is advisory only. In addition, they will report to the appointing divisional committee at least once a year and make such recommendations as they may wish. Each advisory committee will be associated with one or more specific researches; when these are completed the committee will be disbanded; likewise, new bodies will be set up as required. For this reason appointment to such committees will be for an indefinite term of service in contradistinction to the divisional committees where all appointments will be for three years, one-third of the members retiring each year.

The new structure will, therefore, give greater flexibility in operation and it is hoped that the co-ordinating functions of the committees will continue as in the past. In the case of special and sponsored research, control by the divisional committee will be confined to the allocation of additional funds, if any, from the ERA. It is realised that the new structure will give less opportunities for those close contacts between individuals and the work of the ERA. To retain such close association a new idea is put forward. It is proposed to hold technical conferences at which research work in hand by the various sections will be described and discussed and to which all ERA members will be encouraged to send suitable representatives at an appropriate technical level.

Supply growth in South Africa

INCREASED RATE OVER 1958 RECORDED IN ANNUAL REPORT

INCREASED rate of growth in supplies to all consumers during 1959 compared with earlier years forms the background to a considerable expansion programme in generation, transmission and distribution detailed in the annual report of the Electricity Supply Commission for South Africa.

A rise in total units sold of 8¼% for the year ended 31 December, 1959, to 14·72 million units promoted a revenue increase of 13·2% to £36·5 million. Costs increased at a slightly lower rate by 12·7% to £36 million, suggesting that increase in costs consequent upon the Commission's expansion programme, begun in 1952, is now declining.

Generation

The Commission operates 23 thermal stations and one hydro station in its five undertakings. The installed capacity of the thermal stations was 3,300 MW at 31 December, 1959, and a further 570 MW of new plant was on order. In the period May, 1959, to April, 1960, 210 MW of plant was commissioned, notably three 60 MW sets at the Highveld station in the Rand and Orange Free State undertakings. During the earlier part of 1959, two 60 MW sets were commissioned at this station and a further set is scheduled for commissioning later this year. Further demands on the pooled power resources of the Rand, OFS, and Eastern Transvaal undertakings will be met by extensions to Komati station.

Orders for two 100 MW sets for Komati station constitute the major item in the plant construction and on order programme for the year ended April, 1960. This programme totals 540 MW and includes four 60 MW sets. Two of these will be at the Umgeni B station in Natal and the remaining two at Hex River in the Cape Western undertaking the Highveld in the Rand and OFS undertaking. Contracts were also placed during the year for the first 100 MW set at the Natal undertaking's Ingagane station. Site work has begun at this station and the first set is scheduled for commissioning in the winter of 1963.

Commissioning of Cape Town's Athlone power station will mean that Cape Western undertaking will supply a diminishing quantity of electricity to the city. As a consequence, expansion of Escom's system in this undertaking will be met largely from existing stations, and development has been restricted to two 30 MW sets at Hex River. The first set is expected to come into service early in 1961 and the second in 1963.

The report covers the first full working year for the pooled power stations of the Rand and OFS undertakings supplying power to the Cape Northern undertaking. The interconnection and change in cost structure have resulted in sales doubling in two years. Overall cost per unit was reduced in this period from 1·247d to 1·065d.

An important development in the Rand and OFS undertakings is the decision to construct a 275 kV transmission system. The Komati station will be connected initially by two, and finally three 275 kV lines to the Reef distribution system at Nevis. Interconnection is also planned at 275 kV between the Komati and Highveld stations. Altogether, the Commission's programme includes extensions to their h.v. line of 1,248 circuit miles.

Several 132 kV lines were brought into service during the year. In Cape Northern undertaking work began on a 132 kV line from Kimberley to Ulco. In Natal, load growth in the Durban area now requires that bulk supply to the City shall be taken at 132 kV and an additional 132 kV substation is to be provided for the City at Coedmore. Commissioning of the first stage of Coedmore substation was completed in May, 1959, when the Umgeni to Coedmore 132 kV line was brought into service.

Escom is anxious to increase its rural and farm supplies, but as lines are extending, cost of transmission equipment predominates in the cost of each connection. At £1,000 per farm average, the economics of connecting farms and the consumption to be expected is often the subject of lengthy negotiation. Detailed work to meet the requirements of groups of farmers often differ considerably between districts and in many cases it is found that the cost of supply is considered too high by the consumers.

Mining Consumption

The largest consumer of power in South Africa is still the mining industry, and with a total consumption of 7,801 million units in 1959, it was equal to one-tenth of the electricity sales recorded by the British Electricity Council. Nearly all mining consumption is taken by gold and uranium mines.

Industrial supplies showed a 10·3% increase over 1958 to 2,740 million units as a result of expansion in the metal and chemical industries. Mining and industrial consumption represent 52·7% and 18·8% of total supplies by the Commission. Bulk supplies represent a further 21% and traction 6%.

During the year, work continued on preparation of the main line for electric traction between Touws River and Beaufort West in Western Cape undertaking. In the Natal undertaking, nine traction substations were connected during the year and sections of the main line from Midway to Vereeniging and Wattles to Kronstad were converted to electric traction.

Electricity production was seriously affected by the Coalbrook mine disaster in January this year.

The Coalbrook North colliery was normally the sole source of supply for the 480 MW Taaibos station. Immediate steps were taken to transfer load from this station to others and to obtain coal from Coalbrook South colliery and another nearby colliery. Boiler design was unsuitable for other coals and supplies had to be imported by rail. By these means output was kept at 36% below the normal daily figure. During March a failure in another local colliery and the decision to close Coalbrook South colliery necessitated a reduction in generation in southern stations to 80%, and it was necessary to import power from the northern network. Normal supplies were restored on 19 March, 1960.

Top-hats for stress relieving

A FEW years ago a revolutionary form of furnace for firing pottery was developed by Shelley Electric Furnaces to replace the expensive and cumbersome kilns which have so long been typical of the ceramics industry. This was in the form of a lagged and insulated metal box without a bottom, but with electric heating elements mounted on its sides, which can be lowered over a load of ceramic ware on the floor of the firing area and the ceramics fired in place. Meanwhile a second load is set up alongside and, at the end of the firing period, the furnace is lifted and transferred to the second load leaving the first, fired load to cool without moving.

It was obvious that this technique would not remain long an exclusive of the ceramics industry and what must be, for the time being, the daddy of "top-hat" furnaces has recently been installed at the Lilybank Works of John Thompson (Wilson Boilers) Ltd. in Glasgow.

The purpose of the new installation is for heat treatment of welded boilers and pressure vessels for which a stress-relieving cycle of 24 hr—nine for raising to 650°C, three for soaking at this temperature and 12 for cooling—is required.

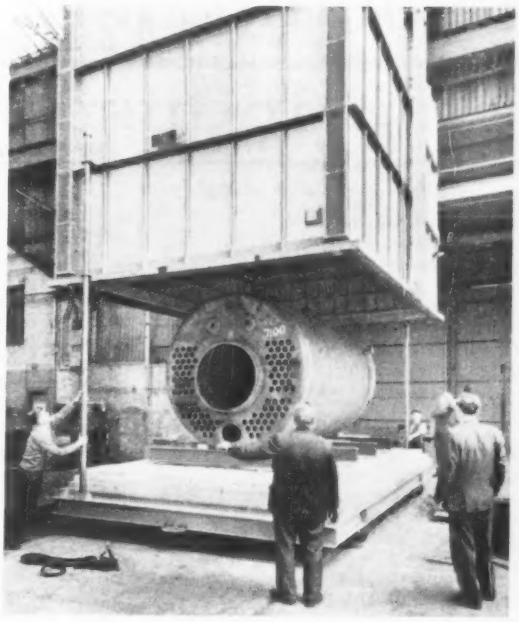
The hearth is in the form of a bogie which can be moved in and out from a bay to a position under a crane which is required for removing or positioning the "top-hat" and loading the boiler on to the hearth. The top-hat is a prefabricated structure having relatively small mass for heating, well lagged with thermal insulation and with the heating elements mounted on the four sides and top, as well as in the hearth. For purposes of temperature control the elements are divided into three zones by programme controllers, the zones comprising (*a*) the base, (*b*) the four walls up to two-thirds of the height of the walls and (*c*) the top extending down to one-third of the wall height.

The electrical load is 360 kW at peak and the furnace cycle is fully automatic and completely instrumented. Interconnecting wiring is by "Pyrotenax" mineral-insulated conductors and the elements are designed with a life expectancy of several years.

The furnace is capable of containing loads up to 17 ft by 11 ft by 11 ft or 15 tons maximum and is capable of heat treating up to seven loads a week. The whole of the air being locked within the furnace, oxidation is reduced to a minimum. If called for, inert gas could be flooded into the interior without difficulty. Cooling is by radiation.

Lower Fuel Costs

It is claimed by the makers that the fuel costs of top-hat furnaces with electric heating are nearly 75% less than those of conventional solid-fuel or oil-fired furnaces, apart from the very much simpler handling arrangements and saving in floor space. By planning the heating period for night-time and cooling by day, advantage can be taken of off-peak tariffs and, with an 11 ton load—a representative one for stress relieving—it has been worked out that fuel is under £1 per ton.



Lowering the top-hat into position over a boiler for stress relieving

A special form of temperature control has been developed in which the current is regulated by saturable reactors, the d.c. regulating current of which is supplied via a programming galvanometer on the control panel. These top-hat furnaces are now being made in sizes from 15 to 2,600 cu ft by Shelleys but even larger ones are contemplated. It is usual for each furnace to be tailor-made to the customer's requirements.

FLOOR-WARMING CABLE TESTER

IMMEDIATE detection of damage to heating cables during the installation of solid-embedded floor-warming systems is made possible by a fault-monitor being marketed by the "Panelec" Heating Division of BICC. By means of a bell and indicator lights, this fully transistorised electronic device gives visual and audible warning of insulation or continuity failures on any make of cable. Consequently, the cables can be repaired or replaced before the concrete screed hardens, saving time and labour.

The monitor is easy to connect and simple in operation. Any number of cables may be monitored simultaneously, providing the total resistance of the cores does not exceed 1,000 ohms. Cable cores are connected in series and the two free ends attached to two terminals on the monitor. A third terminal is then connected to a temporary earth electrode buried in the wet screed with which the cable is covered or, if a screened type of cable is being installed, to the screen.

There is a combined on-off and three-position selector switch. With the switch in position "A," dummy faults are placed in circuit, thus enabling the calibration of the instrument to be checked before it is used. When this check has been completed the instrument is brought into action by moving the switch to the "Monitor" position. Should the insulation resistance of any cable now fall below 5 megohms to earth, or if the core resistance rises to above 1,000 ohms, the bell will ring and an indicator light will show the nature of the fault, whether insulation or conductivity, continuing to operate even if the fault clears itself. Should an internal breakdown develop while the monitor is in use, it will fail safe: a fault will be indicated.

Where a cable is damaged while monitoring, the instrument may be used as an indicator by moving the switch to position "B." The bell and lights will now operate only while the fault is present and will cease as soon as the fault is cleared or disconnected. By connecting individual cables in turn, the faulty loop can be found rapidly, and repaired or replaced.

The instrument, which is robust and portable, weighs 8½ lb and is contained in an attractive grey mottle enamelled sheet steel case, measuring 10¼ in. by 4¾ in. by 3¾ in., fitted with a leather carrying handle.

Priced at £25 10s to the trade, the monitor is available for immediate delivery from British Insulated Callender's Cables Ltd., "Panelec" Heating Division.

equipment for industry

Nylon bearing material

A NYLON material for bearings, Akulon, having a low coefficient of friction and good wearing properties is claimed to be particularly suitable for silent-running gear wheels. Akulon is a long chain synthetic polymeric amide with good mechanical properties. It can be water-lubricated and is resistant to many chemicals. Akulon rods are available from ¼ in. to 2 in. diameter. Their coefficient of friction on steel is an order of magnitude less than steel on steel and good electrical properties are indicated by a dielectric strength of 290 V/mil and breakdown voltage of 30 kV at 73°F.

Good electrical properties are also obtained with "Lignatum" impregnated and bonded-wood veneers. This material is suitable for transformer and switchgear applications by reasons of its high dielectric properties. It combines the natural resilience and strength of timber with the advantages of low moisture absorption ensured by using thermosetting resins. These two materials are recent additions to a range of Leatheroid and Vulroid cellulose materials which have been manufactured for some years. *J. Burns Ltd., Wangye Wks, Chadwell Heath, Essex.*

Universal extension lamp

AN attractive contemporary-styled universal extension lamp has recently been announced by Edison Gill. Price of the lamp ranges from £3 10s for the 30 in. radius to £4 for the 40 in. radius model. To meet the variety of applications for which this type of lamp is commonly used, a range of wall brackets and clamping fittings are available as extras. The lamp is robustly manufactured with a variety of colour finishes. The freely adjustable and extendable mounting is claimed to give a glare-free, concentrated light. *The Edison Gill Co. Ltd., Exhall, Coventry.*

A variety of weighted, clamped and swivel base fittings are available for the versatile Edison Gill universal extension lamp. Models are available with 30, 36 and 40 in. radius arms

Resistor has temperature stability

BY combining wires of different temperature coefficient a precision wirewound resistor having a temperature coefficient of less than 0·0004% per °C is achieved. This is the Type C produced by Alma Components which is available in ranges 100-300, 80 and 120 kilohms ±0·1% at ratings 1 W, ½ W and ¼ W, respectively. Drift is claimed to be initially less than ±0·05% decreasing to a negligible amount after 1,000 hrs. These resistors should be particularly suitable for precision electronic instruments, analogue computers and similar devices. *Alma Components Ltd., 551 Holloway Rd, N.19.*

High quality general purpose c.r.o.

INTENDED for use in the laboratory or for radio and TV servicing, the Taylor Model 33 A oscilloscope is suitable for examining in detail all types of wave form including short duration pulses. The hard valve time-base covers a frequency range of 2 c/s to 100 kc/s with good synchronisation. The amplifiers have push-pull output, the vertical amplifier having a frequency range of a few c/s to 60 Mc/s with high gain. In the event of fluctuating mains voltage, a stabilised power unit ensures a steady trace. *Taylor Electrical Instruments Ltd., Montrose Ave, Slough, Bucks.*

New Circscale features

THE well-known range of Record "Circscale" instruments are now available with two refinements. Easy instrument reading from an angle of 60° to the normal is made possible with a raised front glass. This feature has been called "Clear-View." It is also now possible to supply all moving iron and moving coil instruments in the Circscale range with internal illumination. *Record Electrical Co. Ltd., Broadheath, Altrincham, Cheshire.*

Ultrasonic cleaning

A GENERAL purpose ultrasonic cleaning unit with a capacity of over 6 litres has been introduced. The unit has a rating of 500 W yet its price is little more than smaller units previously available. Applications include cleaning instrument and transistor components, removing radio-active contamination from tools and instruments and polishing compound from jewellery. The cleaning tank is stainless steel and measures 10 in. by 8 in. by 6 in. internally. All normal cleaning fluids can be used. *Kerrys (Ultrasonics) Ltd., Harold Hill, Romford, Essex.*

L.V. soldering irons

OUTSTANDING feature of the new Adamin range of soldering irons is enclosure of the heating element in the bit. The range is available in four to 24 W models and is intended primarily for work on miniaturised electronic components and fine instruments where easy manipulation and absence of radiated heat from the shaft is important. The element is cemented into a stainless steel shaft, a feature claimed to give better heat conduction to the tip and also reduce risk of physical damage. There are 11 irons in the Adamin range, suitable for voltages from 6 to 50 V. The range includes irons with bits varying from 1/32 in. to ¼ in. diameter. A recent addition has also been made to the Litesold range with a 55 W model. *Light Soldering Development Ltd., 28 Sydenham Rd, Croydon, Surrey.*

Resistance weld control

PRECISION control of small spot-welding machines is claimed for a new electronic equipment recently introduced. Designated FCT3, the equipment is suitable for controlling welding machines rated up to 15 kVA at 440 V. It is designed to provide accurate, synchronous timing from ½ to 5½ cycles in half-cycle steps with full range stepless-heat control giving a 30:1 range of power control without taps. An electronic contactor is included in the equipment for switching the welding transformer primary circuit, and transformer saturation is claimed to be avoided even when timing odd numbers of half-cycle welds. An alternative unit gives synchronous timing in two ranges, ½ to 5½ cycles and 1 to 11 cycles. *Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*

Detachable, plug-in sub-chassis are a feature of the Lancashire Dynamo Electronics series FCT3 synchronous weld controller

for the electrical trade

Striplight shaver socket

A TWO-PIN socket has been added to the "Linolite" clip-on bed mirror strip fitting allowing connection for an electric shaver. The basic fitting is about 13 in. long—a 284 mm 60 W strip lamp with metal end caps in white or grey and fitted with a white or pink acrylic diffuser shade. A push-button switch is placed in the centre of the backplate and the socket-outlet on the right-hand end-cap. Price is £3 12s 3d, tax paid. *Linolite Ltd., 118 Baker St, W.1.*

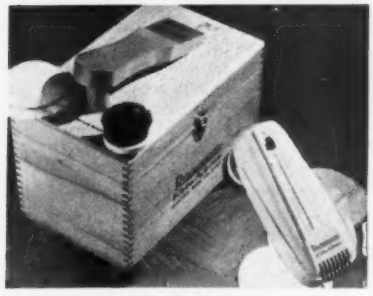
"Iced Diamond" changes colour

A COMPLETELY new interior colour scheme is to be adopted by Hotpoint for next year's "Iced Diamond" refrigerator range. The two models in the range are of 3·7 cu ft and 5 cu ft capacity and apart from the altered interior retain all the original features. Hotpoint have not yet specified what the colours are to be, but they tell us the new models, F37 and F50, will cost no more than this year's, that is, £59 17s and £73 10s, respectively. *AEI-Hotpoint Ltd., 33 Grosvenor Pl, S.W.1.*

Automatic shoe-shine

RONSON are to import an automatic rotary shoe-polisher from the USA in the near future. It consists of a motor in a hand-held plastics case with switch and three accessories for connection to the spinning head. These snap-in connections provide brushes and a pad taking replaceable buffing flannels.

This labour-saver, "Roto-shine," will be available in limited quantities during October, selling at £7 17s 6d. For an extra £1 it will be provided with a polished wooden box standing on wood castors with a foot-rest fixed to the top. The motor carries a one-year guarantee. *Ronson Products Ltd., 352 Strand, W.C.2.*



The "Roto-shine" shoe cleaning kit by Ronson, £8 17s 6d complete

Home sharpening made easy

AN electric knife and scissor sharpener is among the new products described in Pifco's catalogue for 1961. It consists of a roughly rectangular plastics casing housing a 50 W motor with nylon bevelled gears which drives a set of aluminous oxide grinding wheels. There are two slots across the top of the case, one for knives, the other correctly angled for the insertion of scissor blades. Edges are ground simultaneously on both sides and the operation is completed in a few moments, it is claimed. Dimensions of the sharpener are: 7¾ in. long by 4¼ in. wide and 3 in. high. It has a micro-controlled switch and 9 ft of three-core flex. Price £6 6s, tax paid. *Pifco Ltd., Watling St, Manchester 4.*

Electrical masseur

A FOOT massager at quite a moderate price is also included among Pifco's new appliances. It is actually a vibro-stimulator, comprising a small floor-standing platform with a circular foot rest about 4½ in. in diameter. It produces high-frequency impulses which are said to stimulate circulation and soothe tired muscles. The vibration unit, claimed to be extremely robust, does not interfere with radio or TV reception. The platform, styled in cream and maroon plastics, has a switch on its front panel. Price is £4 4s tax paid. *Address as above.*

'Fridge price cut

A reduction in price of £4 11s 9d has been announced for the Electrolux L37 refrigerator. This absorption type model is now priced £56 14s, tax paid.

TRADE PUBLICATIONS

ADAMIN.—Eight-page leaflet and price-list of micro soldering instruments. Light Soldering Developments, 28 Sydenham Rd, Croydon, Surrey.

AEI.—64-page illustrated book on aircraft equipment. Associated Electrical Industries Ltd., Aircraft Equipment Group, Coventry.

BELMOS.—Leaflet F810 on Type RCS flameproof remote control station. Voltage range up to 650 volts a.c. from The Belmos Co. Ltd., Bellshill, Lanarkshire.

DEEGEE.—Illustrated folder on low voltage electric safety blanket and booklet by David Griffin, A.M.INST.B.E., entitled "What Good is Warmth if You Worry About It?" David Griffin Ltd., Wimborne Rd, Poole.

KUWAIT, CRAWLEY, CARPENTER, COURT.—Folders describing fluorescent tube lanterns for Group A, A1, B and intermediate lighting. Siemens Ediswan Lamps, AEI Ltd., Lamps and Lighting Dept., 38 Upper Thames St, E.C.4.

Pygmy 'fridge

THE introduction of what must be among the smallest refrigerators on the market has been announced by Electrolux. The new refrigerator, "Sixteen," is of the absorption type and has a capacity of 1½ cu ft. All the conveniences of the larger cabinets are included, however—three door shelves, crisper tray at the bottom and a freezer compartment which holds one packet of frozen food or a small ice-cube tray. It is ideal for wall mounting, but can be supplied with legs if required. Price is £32 11s, tax paid. *Electrolux Ltd., 153 Regent St, W.1.*

Tubes for 6s 4d

A FLUORESCENT lamp manufacturing firm in Yorkshire which has been supplying tubes at extremely low cost to the locality is now widening its distribution. It offers the usual range of colours, northlight, daylight, white, natural and warm white at 7s for 5 ft and 6s 4d for 4 ft, 3 ft and 2 ft sizes, inclusive of purchase tax. *Fluorescent Starters, Rosse Wks, Moorhead La, Shipley, Yorks.*

Cromptons enter heating field

NOT since the early days of electrical heating have Crompton Parkinson produced electric heaters and, though they can claim to have been among the pioneers in this sphere, their re-entry into it this season with a domestic space heater was on the whole unexpected. Whether the introduction of this new product heralds a full-scale launching into the market, however, Cromptons prefer not to comment.

They have produced a fluid-filled radiator of free-standing panel design heated by a 1 kW immersion element. Known as the "Commodore," it is controlled by a thermostat which responds to the temperature of the fluid, that arrangement being considered safest for this application. The new heater stands only 2 ft 3 in. high, is 2 ft 8 in. wide and, with the base support, 6¾ in. deep. Each of its two faces are of different colours, available in three combinations, gold/bronze, grey/pink and eau-de-nil/cream. Complete with base, or brackets and deflector plate for wall mounting, it is priced £16 9s 6d, tax paid. *Crompton Parkinson, Crompton Hse, Aldwych, W.C.2.*

The new fluid-filled heater "Commodore" from Crompton Parkinson, £16 9s 6d

Did Cable Fault cause Store Fire?

AN electrical defect in a twin-core cable was the probable cause of the fire which resulted in the death of 11 people in a Liverpool store in June, indicated the Deputy City Coroner of Liverpool at the inquest last week. But as evidence developed it became clear that other possibilities will be put forward as to how the fire started. Twenty-six counsel are taking part in the inquest, representing interested parties, including the electrical contractors and AEI Ltd., and Dorman and Smith Ltd., which is continuing.

Opening the inquest, the Coroner said that a full inquiry had been carried out, the results of which would be made available to the jury at the inquest. Amongst those investigating the incident was Mr D. A. Picken, the local electrical inspector of factories. His opinion, and that of the senior fire prevention officer for the Liverpool Fire Brigade, was that the fire started with an electrical defect in an 0·06 sq in. twin-core p.i.l.c.s.w.a. cable. This cable ran from a sub-main distribution board on the first floor of the store to a board on the fourth floor. It was suggested that the fault involved was located immediately below the cable entry duct opening on the third floor and that arcing had occurred between the live conductor and the lead sheath, with about 5 in. of the conductor being burnt away.

In the view of Mr Picken, the arc burnt along the cable until it reached a point where contact was made with the neutral conductor. Only then did the fuse blow. The cable seemed to be bent rather sharply where it went through the ceiling. On visual examination the cable did not appear to be damaged; it was only when it was opened up that fusing of the phase conductor was found.

One other possible cause of the fire was put forward by Mr Picken, the Coroner said. A short-circuit might have occurred in the windings of a fluorescent lamp choke. Lighting fittings were let into a false ceiling and mounted on thin asbestos sheeting.

Witnesses gave evidence that the fire was first noticed as a flickering light and a crackling sound between joints of ceiling tiles above light switches on the third floor. At the time, extensive rebuilding operations were in hand throughout the store and several operatives of the firms concerned gave evidence.

Hot Cables

The foreman electrician of the installation contractors said that he had received complaints about a twin-core armoured cable getting excessively hot, but on test had found it to be carrying currents well within its rated limit. (This cable was not the one feeding the fourth-floor lighting in which the fault was alleged.) On the question of bending cables, his experience was that if a cable was bent sharply the armouring failed first. He said that at the time of the fire the cable in which the fault was suggested was carrying only about 35 amp. Later in his evidence he agreed with Mr Picken that a piece of copper wire had been used to bridge a fuse carrier that would normally have had a cartridge fuse in it.

The electrician who made the joint on the cable alleged to have failed said in evidence that he left it in a position where it was unlikely to sustain damage. There were no sharp bends, and no forcing the cable into position. He had tested it after installation with a 500 V insulation tester.

There was disagreement amongst electrical witnesses about whether it was unusual to find bitumen oozing out of the servings of cables. One thought it not unusual, another suggested that it was "very seldom" that it occurred, and that when he had seen it, there was always something wrong.

DIESEL MAINTENANCE DEPOT

MAINTENANCE of diesel locomotives and multiple stock on British Railways' Eastern Region will be facilitated by a new depot opened at Stratford. This has space for 16 main-line diesel locos under cover in an eight-track 300 ft long shed.

The rails are 2 ft 6 in. above floor level to facilitate work on the locomotives and there are platforms between tracks at normal height. Scheduled maintenance will be performed at the shed; anything as major as removal of an engine or a generator will be carried out elsewhere. Normal practice is for a loco to receive an eight-hour maintenance check every seven days, with heavier work being carried out at three- and six-monthly inspections and at a yearly inspection.

Electrical installations at the depot include provision of 15 amp 240 V earth-proved socket-outlets for portable electric tools and 50 V socket-outlets for hand lamps, both in the interests of safety. Amongst portable equipment provided are battery chargers with four-position tappings and small transformers to enable the internal lights on locomotives to be used without draining the batteries.

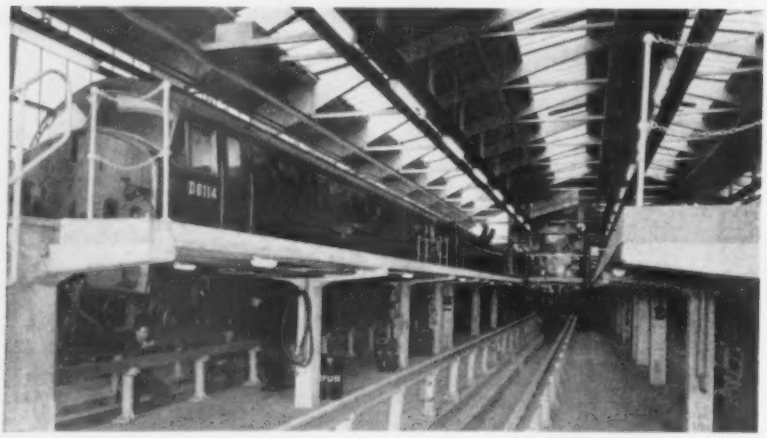
Electric lighting in the maintenance shed is by cold-cathode fluorescent fittings designed to give an intensity of 10 l/sq ft at the working platforms. Lighting fittings are suspended from trunking, with two 15 in. hot-water radiant heating panels each side. Underneath the platforms, lighting is by hot-cathode fluorescent bulkhead fittings, while in the inspection pits, oil-tight metal filament lighting is provided.

At both ends of the shed, yard lighting is provided by means of colour-corrected mercury lamps mounted on 25 ft high concrete columns, with the yard generally lit by 50 ft steel towers having three 400 W colour-corrected mercury-vapour fittings on each.

Electric power services in the shed are so arranged that on alternate tracks facilities are available so that each locomotive berth is covered by:

one 30 amp earth-proved power socket-outlet suitable for battery charging; two 15 amp earth-proved s.o's for general electrical tools; one three-phase 15 amp earth-proved s.o. for special tools; two 50 V s.o's for portable hand lamps.

At each end of the depot there are two 60 amp earth-proved sockets which can be used to feed portable welding equipment. Electrical contractors were Drake and Gorham.



General view of maintenance depot showing cold-cathode main lighting and hot-cathode fluorescent bulkhead fittings beneath platforms

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Earth Connections

SOME time ago an indignant correspondent to a newspaper, under the signature of "Once bit," complained that an electric polisher burnt out when the earth wire was connected. It was not mentioned that the probable reason for the earthing was that the user had been receiving leakage shocks, but it was evident that the polisher had not been tested for earth faults before connecting up. A rebuttal letter promptly pointed out the dangers of using unearthed appliances.

Undoubtedly, most repair departments have their own satisfactory methods of testing electrical appliances for earth faults after repair, but the following notes may be of interest to your readers.

Insulation test instruments may quickly indicate general leakage, but may be damaged if used while the apparatus is still connected to the supply. A test after disconnection may not indicate faults which are caused on some appliances, such as toasters, etc., through expansion of the element when heated.

An earth fault, if it occurs at or near to the live terminal of the appliance, will blow a fuse; if it occurs at or close to the neutral terminal it will not—unless, of course, there is an appreciable out-of-balance current flowing at that point in the system. If the earth is permanently connected, a slight leakage may pass unnoticed, but a leakage anywhere in the circuit between phase and neutral may cause a burnout with or without the earth wire connected. This has occurred in series motors used in polishers, sewing machines, etc., through an accumulation of carbon dust on the brush holders.

It is also important to remember that the rule of connecting the right-hand socket of a socket-outlet to the live line is not always observed. We may, therefore, get the condition that an appliance which does not blow a fuse in one socket-outlet will do so in another if the earth fault is close to one terminal. This can lead to confusion and, possibly, recriminations.

An inexpensive testing board can be made to check appliances for earth faults at either end of the internal circuit. In one form a double-pole changeover switch is inserted between the line and neutral incoming test supply and the test socket; in an alternative form a pair of test sockets are connected in parallel, but with connections on the live and neutral outlets reversed. In both cases a test lamp, shorted by a normally open push-button type switch, is inserted in the earth line to indicate an earth fault. A 15 W miniature lamp will indicate leakages of the order of up to 10,000 ohms; a miniature neon lamp will show a slight glow with leakages up to about one megohm. By inserting the three-pin plug of the appliance in either of the sockets—or in the socket and operating the changeover switch—the presence of a leakage to earth, regardless of the position of the leak point, can be established. A useful accessory for situations where appliances are received with a variety of plugs on the cable is a three-pin plug to match the socket-outlet of the test board wired to a number of test sockets in parallel to suit the range of plugs.—*K. Coombs.*

[*Mr Coombs has pointed out that in his contribution, "Positive Mercury Switching" (14 July), by an error of sub-editing, the float switch is said to be "opened at the pre-determined high and closed at the low level as controlled by the float." As many will have appreciated, the switch opens when the water level falls to a point above the foot valve, leaving the pump primed, and is closed as soon as the water level rises to the set point at which pumping is required to start. We apologise for the mistake.*]

Fluorescent Lighting Ballast

WITH reference to Mr Ralph's letter "Hungry Fluorescent" (25 Aug.), the query which he raises concerning the total consumption of fluorescent lighting fittings originates from the basic factor as to whether the tube is operated with an iron-cored choke or a resistive ballast.

The initial cost of the choke is higher than that of a lamp ballast or resistance element and the resistive device is, therefore, useful in reducing the fitting cost to a minimum. This results in a loss of energy in the resistor which may be more than that of the fluorescent tube itself and this reduces the overall efficiency of the combined fitting and tube. The following values are typical for units operating on a 240 V a.c. supply.

Tube Watts	Resistive		Choke	
	Ballast W	Total W	Ballast W	Total W
80	120	200	15	95
40	60	100	8	48
20	60	80	9	29

It will be seen from the above that, compared with choke circuits, the resistive type of ballast more than doubles the consumption on 80 W tubes and almost trebles it on the 20 W tube. It will also be seen that, where the choke ballast is used, the difference between tube watts and circuit watts is comparatively small and not likely to result in noticeable discrepancies, even in cost calculations. Where resistive ballasts are used, however, I wholly agree that the difference between tube and total watts is such that all fittings employing this circuit should clearly be marked with the total wattage they consume.—*G. V. McNeill.*

Wrong Tapping

MY thanks to Mr McNeill for putting the position so clearly. It makes one wonder why the tungsten filament ballast should ever have been considered a commercial proposition, even though its efficiency is still nearly double that of a tungsten-filament lamp.

On the subject of chokes, however, the losses will not be negligible unless the right tapping is used, as I once discovered.

In the company where I was employed I was responsible for the purchasing of electrical equipment. One day a representative came round and offered a batch of fittings at a very liberal discount. I had not previously heard of the company but the fittings were well made with a hermetically sealed ballast unit on top. I said we would give one a try with the promise that, if it was satisfactory, we would take more. The representative did us the favour of installing the fitting and left. After he had gone I took the opportunity of checking the current consumption and found it was 160 W. Naturally, I thought I had been "sold a pup."

When he returned some days later I pointed out the high consumption and he was obviously astonished. He said that he had never had this complaint before and immediately contacted his firm who told him to send it back for test. The unit was taken down and replaced by another of his fittings and the current checked. This time the load was 90 W. Puzzled, we took the faulty unit to the workshop and carefully inspected it. During the inspection it was noticed that the wander-plug of the ballast was in the 210 V terminal instead of the 240 V. Putting it into the correct hole, we again checked the consumption. To the representative's joy—and my relief—the consumption was 90 W. As you may guess, he left with a substantial order.—*F. R. Ralph.*

News of the Week

POWER STATION COAL PRICE UP

5s 1d a ton increase at pithead

COAL for power stations will cost an average of 5s 1d/ton more at the pithead as a result of the recent round of price increases announced by the NCB. The average increase compares with 10s/ton for coal for houses and railways and 7s 1d/ton for industry generally. The gas industry faces an increase of 6s 8d/ton. Total cost of the increase to the industry will be between £11 million and £12 million in a full year.

Announcing the increase, the NCB say they have held the general level of coal prices since July, 1957. The intervening period has seen a continuous contraction of the industry to bring output in line with falling demand. Considerable savings have been secured through improved productivity, and costs of production were reduced by 1s 6d/ton in 1959. However, savings secured in this way have been more than balanced by the increases in expenditure that have fallen on the NCB. These have included continued capital expenditure on modernisation; a cut back by half in the highly profitable open-cast coal production; and higher wages.

The Board say they have no choice but to increase the inland prices of coal to yield additional revenue of about £60 million in a full year. In fixing the magnitude of the increases for different classes of coal, the NCB have taken into account the present and prospective demands for different classes of coal, and costs of production.

In the last period for which figures are available (ending earlier this year) the CEGB was paying 75s 1d/ton for coal delivered to power stations, so the increase is effectively 6·8%. It is estimated that for the CEGB the increased costs will be between £11 million and £12 million in a full year. In comparing the increase in prices for coal for the supply industry with that for other industries, the low, and still falling, average calorific value of power station coal must be borne in mind, together with the degraded state; most of it is classified as untreated smalls.

B.E.P.C. 1962

APPROACHES have been made for the British Electrical Power Convention to be held at Brighton in 1962, probably in the first week of June. A final decision on the matter is expected next month.

Prestcold move completed

THE transfer of refrigerator production from Oxford and Reading to the new factory at Swansea has, this month, been completed by Prestcold. The new plant, claimed to be one of Europe's biggest and most mechanised refrigerator factories, has an 11-acre production block.

Heater by Crompton

CROMPTON PARKINSON have entered the domestic heating market with a 1 kW fluid-filled thermostatically controlled radiator, priced £16 9s 6d. Details on page 451.

Tariff Reductions —in Londonderry

AS from next month, electricity charges are being reduced by Londonderry Corporation—a month ago Belfast announced a reduction in the off-peak rate. At Londonderry, the reduction is of 0·1d p.u., a saving of £13,500 to consumers in a full year, Mr S. A. Spence, the city electrical engineer, estimates. He has reported that in the past year overall improvement in generation costs had been reflected in the department's working costs.

—and South of Scotland

OFF-PEAK tariffs of the South of Scotland Electricity Board are to be cut, with effect from 1 Dec., Mr W. Hutton, deputy chairman of the Board, announced last Thursday at the opening of a new substation at Falkland. The cut will be made in spite of the increased cost of coal. Details are to be announced shortly.

The new substation is called "Reading Room" cottage, because about 100 years ago a local stonemason held "readings" in it for those interested. In the adaption for its new use, the National Trust for Scotland have co-operated with the Board.

Northern Aluminium name change

THE title of the Northern Aluminium Co. Ltd. has been changed to Alcan Industries Ltd. This new name involves no change of ownership, manufacturing activity or sales policy, its purpose being to identify the company more clearly as a member of the Aluminium Ltd. of Canada group, comprising some 50 companies in all parts of the world. It is also proposed to retain the trade name "Noral" under which the company's products are known.

Appliances at Cologne Fair

THE Board of Trade and BEAMA are collaborating in the organisation of a collective display of British domestic electrical products at the International Household Goods and Hardware Fair in Cologne on 24-27 Feb. next. This arrangement follows the successful similar co-operation between the two organisations in a display at this year's Spring International Goods and Hardware Fair at Cologne. For next February's show, an island site of 3,200 sq ft in a prominent position in Hall 2 has been booked.

Magnavox enters U.K. market

THE American radio and TV firm of Magnavox has set up a subsidiary in this country for the production of record players, radios and tape recorders. Known as Magnavox Electronics, the new company controls Collaro Ltd. and operates from the Collaro works at Barking. The firm intends to continue its US practice of rigid control of retail price structure, completely protecting dealers against stock price decline. Their distribution programme includes a scheme whereby incentives to salesmen will be borne by the company.

The first five products of the new company are expected by early next month, with TV receivers available during next year.

Sir Willis Jackson, IEE president, opened the new £300,000 Electrical Engineering Department at Robert Gordon's Technical College, Aberdeen, last week. He is seen here, right, with Dr Eric Wilkinson, head of the department, inspecting the 300 kV 3-stage impulse generator. An analogue computer and a closed-circuit TV system are among additions

Free Electricity for Life

THAT eye-catching prize is being offered by A. J. Flatley Ltd. in a national competition for the public this autumn. They offer an alternative of £500 in cash, in addition to a further £500 if the prize-winning entry is accompanied by the guarantee card from a Flatley product bought during October and November. There is also a dealer prize of £50. Publicising the competition, the company is taking six full-page advertisements in national newspapers.

Simplex Dairy factory opened

THE new £100.000 factory of the Simplex Dairy Equipment Co. Ltd. at Sawston, Cambridge, was officially opened last week by the Hon Lady Gamage, wife of Sir Leslie Gamage. Simplex—a member of the GEC group—is now housed "under one roof" for the first time. Previously, there were three offices, three works and six stores, all in different parts of Cambridge. At Sawston, 54,000 sq ft of the ten-acre site is devoted to office block, boiler house, factory and canteen building.

Boards' appliance sales down in July

FURTHER evidence of the depressed state of the major appliance market in recent months is indicated in the sales of new appliances by the area electricity boards, reproduced below. As expected, washing machines and refrigerators are the main items affected, although the sales of the former, 7,179 in July, were slightly above those in the previous month. For refrigerators, however, the sales total of 16,425 in July compares with 29,833 in June and 22,513 in May. Our poor summer may be partly to blame for the decline, which looks even more serious against the July, 1959, total of 29,277 refrigerators sold by the boards.

Appliance Sales by Area Boards	Sales in month ended 31 July, 1960		Sales in 12 months ended 31 July, 1960	
	Total	% change over July 1959	Total	% change over previous 12 months
Cookers ...	26,782	− 4·5	338,794	+ 5·4
Water Heaters:				
Immersion	23,414	− 6·3	192,209	+ 4·8
Storage ...	5,502	+10·8	66,798	+17·1
Washboilers	4,543	−19·6	60,991	−17·2
Washing Machines ...	7,179	−44·6	139,511	− 9·9
Refrigerators	16,425	−43·9	155,085	+ 6·2

Sales of electric cookers are beginning to pick up again, it seems, although the total for July was still nearly 6,000 down on the figure for March, before the introduction of h.p. restrictions. It should be remembered that these sales by area boards represent only a part of the total sales throughout the country.

Appliance deliveries down in April – June

THE impact of the hire-purchase restrictions imposed at the end of April this year is clearly shown in the BEAMA statistics of deliveries of domestic electrical appliances in the three months ended 30 June last, shown below. In particular, those appliances requiring 20% deposit and repayment over two years, such as washing machines and vacuum cleaners, show very disappointing trends compared with the corresponding period of 1959. But other appliances treated more leniently by the restrictions have not been so strongly affected.

Home deliveries of electric cookers, at 120,000 for April-June, 1960, compare with 112,000 for January-March, 1960, 130,000 for October-December, 1959, and 102,000 for July-September, 1959. Production of immersion heaters in the UK between April and June last year totalled 210,000, while over the same period this year, home and export deliveries amounted to 261,000—3,000 of them for export.

Manufacturers' Deliveries of Domestic Electrical Appliances for the three months ended 30 June, 1960

Appliance	Home Market		For Export	
	Thousands	Value £000s	Thousands	Value £000s
Electric blankets	82	205	2·8	6·6
Cookers, domestic types:				
(a) below 5 kW	23	282	1·4	10·8
(b) 5/12 kW	120	,276	3·5	96·1
Dishwashers	1·7	\09	1·0	43·8
Floor polishers and scrubbers	5·2	75	13·6	115·1
Hand hair dryers	54	97	16·5	28·6
Irons (a) non-automatic	50	30	9·9	6·6
(b) automatic	354	639	130·2	191·9
Dry shavers	164	650	n.a.	n.a.
Space heaters up to 3 kW	337	1,363	7·0	26·9
Spin dryers	8·5	162	4·1	53·6
Heated tumbler dryers	2·4	69	1·0	27·4
Toasters	42	136	15·5	48·2
Food and drink mixers to 3 quarts capacity including all hand held ...	21	277	13·4	163·0
Domestic electrical refrigerators (supplied by the Domestic Refrigeration Development Committee) ...	338	n.a.	36·2	n.a.
Vacuum cleaners	274	3,775	50·8	437·0
Washing machines with electrically driven means of agitation including:				
(a) those with hand or power wringers	119	4,256	23·4	575·6
(b) combined with a spin dryer	107	5,686	35·4	1,048·5
Water heaters:				
(a) immersion, up to 3 kW ...	258	446	3·9	7·8
(b) storage, up to 30 galls.	44	460	3·3	41·6
Washboilers (up to 10 galls.)	46	310	1·1	8·8
Total value (excluding 'fridges) ...	£23,303,000		£2,938,200	

Note: n.a. = figures not available.

C.E.E. MEETS IN LONDON

THE first time for six years the International Commission for the Rules on Approval of Electrical Equipment (CEE) has been holding its autumn series of meetings in London. Meetings began last week and continue until tomorrow. They are being attended by 120 delegates from 15 member countries. One of the important subjects on the agenda has been the date for adoption of the green/yellow colour code to identify the earthing core of flexible cables.

Current recommendation is for adoption of this coding by 1 July, 1961, and the meeting has been concerned as to how far individual countries will be able to meet this date. Other matters discussed have been rating, performance and safety aspects of switches built into domestic appliances, safety requirements for lighting fittings, and dimensions and tests for rubber and plastics-insulated cables.

Meetings have also been held to draft statutes and rules of procedure for CEE. Plenary sessions will be under the chairmanship of CEE's president, Professor J. C. van Staveren of the Netherlands, director of the KEMA laboratories at Arnhem. As part of the social side of the conference, delegates and their ladies were entertained last Friday by the London Electricity Board. The reception was held at the County Hall where, after being received by the chairman and Mrs Irving, the deputy chairman and Mrs Todd, as well as the chairman of the LCC, the guests had an opportunity of viewing the building.

Heating and Ventilating Show

OVER 70 firms have already booked 30,000 sq ft of space at the first Heating, Ventilating and Air Conditioning Exhibition—to be held at Olympia in September, 1961. Several overseas firms are included. Industrial Exhibitions Ltd. anticipate that all space will be taken up before the closing date.

SUPPLY MANAGEMENT ON TRIAL?

"THE TUC should take a more positive action against recalcitrant employers and as a first exercise they should put the management of the electricity supply industry on trial for provoking unrest in the industry, which could have resulted in the most serious strike in modern times." That attack was made by Mr Ted Hill, general secretary of the Boilermakers' Society, and newly elected chairman of the TUC in his Union's journal last week. He alleged that the electricity supply officials sat on the fence for a couple of weeks before granting pay increases to manual workers "to see how the workers reacted to the tribunal's rejection of their claim" (Mr Hill was a member of that tribunal, which could not agree—a decision being left to the chairman, Mr Roy Wilson).

Mr Hill believes that "had it not been for the generosity of the workers in giving strike notice, as against direct action, the whole of the industry would have been paralysed." (The strike action to which he refers, was threatened by an unofficial shop stewards' movement.)

In a further lunge he also criticises the Electricity Council for what he terms its high rate of capital re-equipment and re-investment out of profits—an average of 42% since 1948, which is expected to rise to 50% by 1965. He considers this rate penalises the present generation of workers, which is very unfair, "and if this position is not remedied, it is bound to have serious repercussions sooner or later," he adds.

Mr R. G. Cook, secretary, trade union side of the NJIC has also complained of "Government interference" in wage negotiations in electricity supply.

OFFICIAL PUBLICATIONS

BS 607. Concrete poles for Electrical Transmission and Traction Systems. 4s 6d.

BS 936. Oil Circuit-Breakers for Medium-voltage A.C. Systems. 15s (see page 446).

Factories Act, 1959 (Commencement No. 3) Order, 1960. SI 1611. HMSO. 2d.

First Aid (Standard of Training) Order, 1960. SI 1612. HMSO, 3d.

Storage of Petroleum Spirit and Petroleum Mixture. Fire Protection Association. 2s (see page 458).

Factories Act. Certificate of Exemption, No. 26. Electrode Boilers. HMSO, 2d (see page 457).

Chief Inspector of Factories, Report for 1959, HMSO, 7s net (see page 429).

Chief Inspector of Factories, Report on Industrial Health, 1959. HMSO, 3s 6d (see page 429).

Guide to Statistics Collected by HM Factory Inspectorate. HMSO, 4s (see page 429).

Radio Research, 1959. DSIR Report. HMSO, 3s.

Council of Industrial Design. Report for 1959-60.

NEW HONEYWELL FACTORY

A 30,000 sq ft factory is to be built at Hemel Hempstead for the Systems Department of Honeywell Controls Ltd. It is expected to begin operations in 1961 with a staff of over 100, producing data-handling systems, digital computers, scanners and panels for industrial control schemes. There is space for further extension.

Main-Stott amalgamation

THE resources of Stotts, of Oldham, and R. and A. Main, two prominent manufacturers of catering equipment, have now been combined as a result of the former's amalgamation with Glover and Main Ltd. The two companies will in future, for all catering equipment, trade only under the name of Stotts of Oldham, and it is expected that the amalgamation will become effective on 1 Nov., 1960.

N.C.B. cable requirements

WIRE-ARMOURED paper-insulated cables purchased by the NCB for use on the surface and underground and in shafts now have to comply with NCB Specification 202/1960. The specification covers cables up to 11 kV and largely follows BS 760. However, the range of conductor sizes is more restricted than in the BS and there is specific information on acceptable types of construction. In addition to voltage and conductor-resistance tests, cables are required to meet the bonding and drainage test of BS 760 on a batch-sampling basis, and also the fire-resistance test relating to p.v.c. sheath cables, with additional limitations on total length of the cable burnt or charred in the test.

Steelworks and other large contracts

A CONTRACT worth over £500,000 for the 33 kV and 11 kV cable installation at the new Spencer steelworks being built by Richard Thomas and Baldwins, at Newport, Mon. has been awarded to AEI. It comprises 15 miles of three-core and 2½ miles of single core 33 kV solid type cables, 20 miles of 11 kV three-core cables and four miles of 11 kV single-core cables, all sheathed with p.v.c.

THE General Electric Co. Ltd. have received two contracts totalling £362,000 for plant for the new Spencer steelworks. One covers nine 1,500 kW, 460 V, steel-tank mercury-arc rectifiers with associated transformers and earth-leakage and regenerative control panels. The other is for the complete electrical equipment for a 62 in. wide continuous pickle line. The different sections of this equipment will be driven by Ward-Leonard motors totalling over 5,000 h.p. Control desks and a large number of a.c. drives are included.

FILM Cooling Towers (1925) Ltd. have been awarded the contract for concrete natural draught water cooling towers for the power station and for the blast furnace and gas cleaning plants at the above new steelworks. The firm are also to supply three large cooling towers for the Richborough generating station.

PREFORMED Line Products (Gt. Britain) Ltd. have received an order through BICC for 34,800 sets of Preformed aluminium alloy armour rods for Pakistan.

THE Air Ministry has chosen an AEI 1010 data-processing system, valued at £600,000, for controlling the distribution and issue of equipment and supplies to the RAF throughout the world.

RACAL Enginering Ltd. have secured a £100,000 contract from SHAPE for single sideband air-transportable h.f. radio stations.

SULZER Brothers, Switzerland, have ordered from Quasi-Arc Ltd., a complete automatic welding installation for the fabrication of penstock pipes from 16 in. to 8 ft dia.

ETCTA IN SCOTLAND

A branch of the Electrical Trades' Commercial Travellers' Association has been formed in Scotland. Its first chairman is Mr A. M. Scales, here seen, right, with Mr L. S. Hargreaves (president) and Mr R. H. Corlett (national chairman). Over 70 new members have been enrolled. First Scottish meeting is to be held in October. Details from Mr S. G. Clark, secretary, 24 Carnock Crescent, Barrhead, Glasgow

Apprentice Training in Scotland

EVIDENCE that good progress is being made towards establishing a "very satisfactory" scheme for training professional electrical engineers is expressed by the Scottish Electrical Training Scheme Ltd. in a statement issued on the occasion of its fourth annual conference. At the conference, being held tomorrow, directors of SETS Ltd. and 100 trainees are guests of the N of S HEB for visits to generating and switching stations.

Progress with SETS has been faster than was expected when the scheme was first set up. Three graduates completed their courses and joined member companies of SETS in 1959, and 11 in 1960; 17 will complete their training in 1961 and 20 in 1962.

Although most of the trainees come from Scottish universities and technical colleges, Cambridge, London and Dublin are also represented.

The training activities continue on the same lines as in previous years and two features introduced a year ago are now confirmed as permanent features. One is monthly meetings for all graduate trainees within reach of Glasgow, at which they receive talks on technical subjects. The other is an arrangement whereby there is an eight-week intensive "school basic workshop training" course (half mechanical, half electrical) at which apprentices receive instruction on hand and machine tools. The organising secretary is Mr J. E. C. McCandlish.

New S.W.E.B. service centre

LATEST of the South Western EB's service centres, that at Bridgwater was formally opened last week by the Mayor of the Borough. The occasion was marked by a speech by Mr S. F. C. Whitmore, deputy chairman of the Board, who stressed that the Board "always make doubly sure that the reliability, quality and technical performance of all electrical appliances sold—and, indeed, the safety thereof—are put before profit." The Board would not enter the world of price cutting at the expense of service to the public. Mr Whitmore estimated that nearly £1¾ million had been spent on improving the system in Bridgwater since 1958.

More Factory Act requirements

SECTIONS of the 1959 Factories Act dealing with cleanliness and first-aid come into operation on 1 Jan., 1961, and 1 July, 1961, respectively, as a result of orders made last week by the Minister of Labour. The first allows the Minister to prescribe materials other than oil paint for decoration of certain parts of factories, and gives him power to require repainting of these parts at intervals less than the seven years previously applying. The other part of the Act permits him to prescribe conditions for training of people nominated in charge of first-aid facilities where more than 50 workers are employed.

In the latter connection, another order has been made requiring first-aiders in such factories to be registered nurses, enrolled assistant nurses, or people holding a certificate of first-aid issued within the immediately preceding period of three years by a training organisation such as St. John Ambulance Brigade, the St. Andrews Ambulance Association, or the British Red Cross Society.

E.W.F. in Scotland

THE annual function of the Scottish Section of the Electrical Wholesalers' Federation is to be held at the Marine Hotel, Troon, from 27 to 30 Sept. On the morning of 28 Sept. the Council of the Federation will hold a meeting, along with the Scottish members. A golf competition has been organised and a dinner will be held on the evening of 29 Sept.

Fewer fittings for industrial electric boilers

CERTAIN fittings previously required under the Factories Act, 1937, do not now have to be provided on electrode boilers and electrical immersion heated boilers. Certificate of Exemption No. 26 (General) 1960, published as Factory Form 697, grants exemption from the need to provide a transparent water gauge to show boiler water level. The Certificate of Exemption, which is dated March, 1960, also continues the previous exemption from the requirements that a suitable fusible plug or an efficient low water alarm shall be provided.

Classes of boiler covered by the certificate are defined as those in which steam is generated by passing an alternating current through the water by means of electrodes and those in which heating is by means of a metal coil or element fitted within the boiler and energised by an electric current.

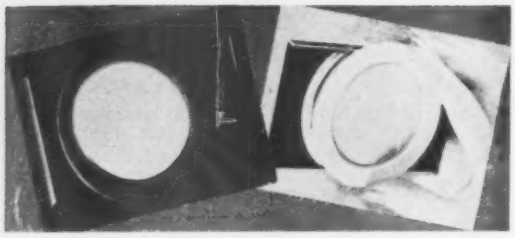
I.A.E.A. in Session

DISCUSSIONS on nuclear power are scheduled to occupy an important place in the programme of the fourth general conference of the International Atomic Energy Agency, now meeting in Vienna. Apart from technical decisions, the conference will have to consider a 1961 work programme involving a budget of £2½ million.

Before the conference will be a report from the board of governors of the Agency reviewing costs of nuclear power, and suggesting that important cost reductions are expected as a result of technical advances and experience. The recent conference on small and medium-power reactors is understood to have confirmed such expectations. Also planned is a round-table discussion on disposal of radio-active waste, and another on power reactor development. The conference began on Tuesday and is expected to last two weeks. Delegations from 70 member countries are attending.

REINFORCEMENT FOR PLYMOUTH

Three 33 kV cables were laid under the River Plym last week by the South Western EB's central construction department as part of the district's reinforcement scheme. At present cables run across a road bridge, which is being reconstructed by Plymouth Corporation and a new cable connection has had to be provided. Cables were taken across the river by a barge carrying three 12-ton cable drums. Later pilot cables were run and all the cables bedded down in the bed of the 320-yd wide estuary at low tide, in a trench formed by men on foot using a high-pressure water jet. Where necessary, bags of cement have been laid over the trench to prevent fouling the cables



This "Panelescent" electroluminescent night light, 3¼ in. dia., now being marketed in the USA, is claimed to have a life expectancy of nearly five years, and consumes less than 3c worth of electricity a year. Electroluminescent panels up to 24 in. by 36 in. are being produced

FARADAY LECTURE PLANS

FARADAY lecturer for the coming IEE session is Mr L. J. Davies, director in charge of research and education for AEI (Rugby) Ltd. In 11 presentations of his lecture up and down the country, Mr Davies will be speaking to the title "Transistors and All That." He plans in this "popular" (as distinct from highly technical) lecture to consider what transistors are, how they are made, what is their principle of action and what they may be used for. As usual, the lecture is planned to be extensively illustrated, one item being a short film on "how to make" a transistor! Mr Davies' many qualifications for delivering a lecture on this subject include recent responsibility for design of an extensive new research laboratory at Rugby, much of it planned especially for semi-conductor work.

Tickets for the lecture can be obtained from appropriate honorary secretaries of IEE centres, etc., except for the London lecture, for which tickets may be obtained from the secretary of the Institution. Dates of lectures are: Rugby, 16 Nov.; Bristol, 8 Dec.; Swansea, 13 Dec.; Manchester, 24 Jan.; Leeds, 26 Jan.; Portsmouth, 14 Feb.; London, 16 Feb.; Birmingham, 28 Feb.; Leicester, 2 Mar.; Edinburgh, 21 Mar.; Newcastle, 23 Mar. Requests for tickets should be accompanied by a stamped and addressed envelope.

TV boost for Berry's mixer

AN intensive TV advertising programme for the "Magicmaid" electric mixer is planned by Berry's Electric, timed to hit the peak of the mixer-buying season. The first broadcast is scheduled for 4 Nov. and the unusual step of using 90-sec spots will enable all the advantages of the mixer to be demonstrated. The programme will be confined to the London transmission area and is being regarded as a test advertising drive, the results of which will determine future sales policy. The trade are asked to give this special drive their full support.

STOCKS BUILD UP

STOCKS held by manufacturers and distributors increased by some 2% in the second quarter of this year, both at book values and volume, according to Board of Trade estimates surveying all trades. Manufacturers' stocks and work in progress is provisionally estimated to have increased by £90 million (at 1954 prices) —about 2%—during the quarter. This stated that only a small part of the physical increase in stocks can be attributed to stocks of finished goods, the main increase having been in materials and fuel which, after allowance for seasonal adjustments, accounted for over 75% of the change. Wholesalers' stocks rose by £16 million (about 1½%) and retailers' stocks showed a further small increase in the period.

Modernise Volk's railway? — No! say committee

PROPOSALS that Brighton's sea-shore electric railway should have new rolling stock of modern or futuristic design in Fibreglass, have been rejected by the Corporation's Entertainments and Publicity Committee. The latter are of the opinion that "in this age of speed and streamlined vehicles the present Volk's electric railway, with its unhurried pace, rolling stock of antique appearance and spartan comfort, provides a unique attraction for holidaymakers which should be maintained."

The general manager and engineer of the Transport Dept. had pointed out that the present rolling stock had been taken over by the Corporation in 1939, reconditioned after the war, and since maintained on a "make-do-and-mend basis." Cost of building four bogie cars in fibreglass would be £5,325 each. He is now to estimate the cost of repairing existing vehicles for the next five years.

INSTALLATIONS IN PETROL STORAGE

POINTS to watch in electrical installations when petroleum is stored are set out in *Storage of Petroleum Spirit and Petroleum Mixture*, Booklet No. 32 of the Fire Protection Association which has recently been issued in revised form. One of the particularly useful sections is a full statement of conditions applying to electrically operated pumps at petrol filling stations taken from the Home Office "model code." (These were printed in ELECTRICAL TIMES, 7 April, 1960.)

The booklet notes that each local authority (outside London, the district council) may impose such conditions as it thinks fit on the manner of storage for petroleum spirit and petroleum mixture and may impose these regulations by the issue of licences. The general recommendation for electrical equipment is that equipment should either be certified flameproof to Group II by the MoP, or be intrinsically safe. All circuits should have automatic protection against overload, short-circuit and earth-leakage and special attention should be given to earthing. In general these considerations should apply to electrical equipment installed within 50 ft of any place where petroleum spirit is kept, handled or exposed in bulk.

Non-destructive Testing

OVERSEAS industrial technologists and scientific research workers are catered for by a two-week British Council course in the non-destructive testing of materials which begins in London on 16 Oct. Aim of the course is to provide a broad survey of work in progress in the UK on this field, and to this end there will be lectures, discussions and visits. Visits will be arranged both to research establishments at present investigating non-destructive testing techniques and to enterprises where such techniques are in routine use. The course is residential and the fee has been fixed at £47.

Fire from electric fires

SIX cases of death through clothing being ignited by electric fires are recorded in the current number of the *F.P.A. Journal*, published by the Fire Protection Association. The report covers the period Jan. to March, 1960. The issue also contains extracts from the Registrar General figures for England and Wales, 1958, during which year there were 52 cases of death caused by clothing being ignited by an electric fire, and seven caused by falling on to an electric fire.

I.E.C. discusses rectifier standards

MERCURY-ARC inverters was among subjects discussed by delegates at a recent IEC meeting. Recommendations were considered, in particular, for a proposed supplement to Publication 84 which deals with this subject and is of special interest in view of the role of inverters in h.v. d.c. transmission. In the allied field of semiconductor rectifiers, recommendations are to be published shortly for polycrystalline stacks, those for monocrystalline stacks having reached the draft stage. Also on the agenda were power convertors for electric reversing drives for which an international working group was nominated to prepare draft standards.

Graphical symbols representing electrical circuit components is another important field in which IEC have been active. Approved for publication are symbols for such items as valves, rectifiers, switchgear and transmission lines, draft approval having been given to other miscellaneous electrical symbols.

War Office and M.oA. Inspection

NEW arrangements for inspection of equipment for the Army and the RAF will apply from 1 Nov. next. They result from the transfer of procurement responsibilities following on winding up the Ministry of Supply last year. The Inspectorate of Armaments, the Inspectorate of Fighting Vehicles and Mechanical Equipment, and the Chemical Inspectorate will in general be transferred to the War Office, while the Aeronautical Inspection Directorate and the Electrical Inspection Directorate will remain with the Ministry of Aviation. The War Office will accept MoA inspection in the aircraft, guided weapons, electrical and electronic fields, while the Ministry of Aviation will accept War Office inspection in the vehicle, armament and chemical fields. Inspection of all electrical and electronic equipment is to remain with EID. Co-ordination in inspection will be effected by Regional Superintendents of Inspection, who will in future serve both the departments concerned. Regional and district boundaries will be unchanged.

Steels for Nuclear Reactors

RECENT research in Canada, the USA and the UK will be reported in 20 papers to be presented at a symposium on steels for reactor pressure circuits, organised by the Iron and Steel Institute for Wednesday, 30 Nov., to Friday, 2 Dec., next. The symposium will open with an introductory lecture by Sir Leonard Owen of the UKAEA, and will comprise sessions on high temperature properties of steels, corrosion, fabrication aspects, irradiation effects and on steels for reactors of the future. Participation in the symposium is open to all and further information may be obtained from the secretary, The Iron and Steel Institute, 4 Grosvenor Gdns, S.W.1.

Sayings OF THE WEEK

"There are, of course, no purely accidental discoveries: there may be unplanned ones, but they become discoveries because a trained and alert mind spots the unexpected." . . . MR J. M. WALDRAM, at the APLE conference.

"In Europe, the EFTA arrangements are opening up new possibilities not only for fully manufactured goods, but also for parts, components, assemblies and materials for incorporation in finished products." . . . F. J. ERROLL, President, Board of Trade, at ISMA London branch luncheon.

"The example set by a major State-owned industry can only serve to discourage industry generally in the long struggle to maintain price stability and check inflation." . . . Federation of British Industries' statement on coal price increases.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, September 20

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	236½	+2
" (3 months)	236½	+1½
LEAD, refined pig, 99·97% purity (cash)	70	−1
" (3 months)	70½	−1
TIN, refined, min. 99·75% purity (settlement)	805½	−12½
" (3 months)	803	−8
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	207½	—
SILVER (Troy oz)	79½d	—
ZINC, virgin, min. 98% purity (cash)	86½	−2½
" (3 months)	86	−2½
RUBBER, per lb		
No. 1, RSS, spot	31½d	+½d
c.i.f. basis, ports, Nov. ...	30½d	+½d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69½	−½
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	—
Lead, (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

HOME HEATERS ON SHOW

THE main item in the autumn display at the Design Centre, Haymarket, is an exhibition entitled "Heating Your Home," open until 29 Oct. and intended to show what is considered representative of best construction and appearance in various solid fuel, oil, gas and electric appliances. The display is arranged in three sections showing appliances for complete heating, partial heating and local heating. These sections are defined in a leaflet available at the exhibition for 9d or by post for 1s.

Complete heating is depicted by oil-fired, gas and solid fuel stoves. Electricity is only acknowledged as a means of thermostatic control or for silent pumping in small bore water heating systems.

In the partial heating section, underfloor heating is mentioned in passing and it is only in the section on local heating that electrical appliances predominate. About a dozen appliances illustrate current styles in radiant heaters and convectors, with and without fans. Although electrical appliances form only one fifth of the display, their styling influence is apparent in other fittings. Several of the solid fuel fires resemble refrigerators and a radiant gas heater is almost indistinguishable in appearance from its electrical counterpart.

U.S. nuclear policy

ACTIVITIES of the USA in the nuclear field are to be the subject of a five-volume report by Mr R. McKinney to be published by the US Joint Committee on Atomic Energy. Its title will be "Review of the International Atomic Policies and Programmes of the United States." Mr McKinney was the first permanent representative of the US on the International Atomic Energy Agency.

MATERIALS PRICES DOWN

A REDUCTION in the prices of basic materials used in many industries is shown in the index published by the Board of Trade. For materials and fuel used in the electrical machinery industry the index figure for August is down to 117·0, compared with the previous month's 117·4. Some of the reduction is accounted for by a decline in raw rubber prices. Other figures, used in the BEAMA Contracts Price Adjustment Formulae, are given on page 462.

In the list of commodities produced in the UK, the index figure for domestic electrical appliances also dropped from 103·1 in June and July to 103·0 in August, while for electrical porcelain the figure has remained at 117·4 over those three months.

Index to Vol. 137

COPIES of the index to Vol. 137 of the ELECTRICAL TIMES, January to June, 1960, are now available free of charge from these offices.

News in Brief

The diamond jubilee of the Electrical Contractors' Association of Scotland will be held on 6 Oct. at the Grosvenor, Glasgow.

Barnsley TC have approved a proposal by the Yorkshire Electricity Board that, for a period of six weeks, immersion heaters be installed in Council houses free of charge to the tenants. At the end of the period, tenants may opt to hire or purchase the installation or have the heaters removed.

Annual conference of the National Society for Clean Air is to be held at Harrogate from 5 to 7 Oct.

All tickets for the ASEE Ladies' Night on 17 Dec. have been sold.

An exhibition of industrial products will be staged by Simplex Electric Co. Ltd., Mersey Cable Works Ltd., and the Power Centre Co. Ltd., in co-operation with the Merseyside and North Wales Electricity Board at the Electrical Industries' Development Centre, 83 Paradise St, Liverpool 1, from 27 to 30 Sept.

Ekco Heating have introduced a heating advisory service for gardeners and horticulturists, covering both greenhouses and soil heating.

Company Activities

THE biggest shock in Stock Markets last week was the Vactric turnabout from a record £635,000 profit in 1958/59 to a £122,000 trading loss after depreciation and a £179,159 provision for bad and doubtful debts. Before this bombshell exploded Vactric's 5s Ordinary shares had started out the week at 20s 3d to show a yield of 9% on the 2·9 times covered dividend of 36¼% paid last time. But how quickly these relationships were shattered by Vactric's decision not to pay any final dividend this time against the previous 25%. Down plunged the shares 4s 9d to 14s to yield no more than 5·4% on the basis of the single interim of 15% paid in February. Later the Ordinary recovered to 16s 10½d and the 5s "A" Ordinary struggled back to 13s 7½d after 13s to yield 5·4%. Nearly a year ago Chairman Mr W. Pegley refused a 55s a share takeover offer on the grounds that it did not take fully into account the earnings potential of the Group—which seems now to have been true enough—while this year, too, the 5s Ordinary have been as high as 43s 9d.

Philips Lamps came to the rescue of Ada in distress: perhaps someone will come to the aid of Vactric. At 16s 10½d the 5s Ordinary might now prove an interesting buy.

Then we had Associated Electrical Industries to show us again how the combined effects of competition and "squeeze" are nibbling into profit margins. Output in the six months to 30 June, 1960, was 6½% up on the corresponding period of last year but gross trading profit rose by only 2½% while the £4·94 million profit after depreciation was 1½% down. In fact, profit margins, measured as profit before tax as a percentage of output, are now at their lowest for a number of years. From 6·3% at the beginning of 1958 they have in this short time dropped to a latest 48·5%. A second interim of 6d makes the payment on the £1 Ordinary shares 1s to date but the Market decreed that the shares should be marked lower over the week from 49s 4½d to 48s 3d.

This was also the cue to knock English Electric down to 35s 6d from an earlier 37s. GEC, on the other hand, still under the spell of merger whispers, were little affected at 39s 9d although in a mid-week flurry the shares rose to 40s 7½d.

Elsewhere in the market, Dimplex shares advanced to a new peak of 39s 9d on the £310,000 before-tax profit and the 30% dividend, both better than the £225,000 and 25% estimates in this newcomer's prospectus. And for a change, last week, the company's present demand, despite the credit squeeze, is so heavy that existing manufacturing capacity is having to be enlarged.—*From our City Correspondent.*

Associated Electrical Industries

Before tax, but after depreciation, the group net trading profit for the six months to 30 June is £4,940,000 (*£5,010,000*). Second interim is again 6d per share. Value of output during the period rose to £101·9 million (*£95·6 million*), while orders received jumped to £113·3 million (*£84·9 million*).

Christy Bros. Ltd.

The turnover of the holding company in the year to 31 March was substantially higher quite apart from that attributable to the Ipswich electrical contracting business of B. C. Bullard and Co., acquired during the year. Sales of electrical appliances continue at a satisfactory level (turnover of the Chelmsford showroom was a record last year) and the department for the manufacture of special control and switch panels has been at full capacity, Mr A. A. Gates, the chairman, reports.

A. C. Cossor Ltd.

Once again Ordinary shareholders get no dividend—operations for the year ended 31 March last resulted in a loss of £121,595, compared with the previous year's profit of £206,750. The directors attribute the loss to shortage of orders for radar and electronic equipment, loss on certain Government development contracts and production difficulties in the domestic equipment field.

Dimplex Ltd.

A final dividend of 20% makes the total 30% for the year to 30 June last, against the 25% forecast last December. It is proposed to increase the capital to £500,000 by the creation of 1,000,000 5s shares and to capitalise £50,000 of reserves in a one-for-five free issue. Profit for the year is £310,371 (*£177,202*) and net profit after tax, £157,115 (*£91,730*). A lease of 10,000 sq ft of additional factory space was taken in the year and recently a further 19,400 sq ft of land adjoining the present factory was purchased. Mr E. J. Wade, the chairman, adds that the order book for the current year is highly satisfactory.

Kenwood Manufacturing Co.

Late delivery of a special machine tool for the production of the new Kenwood "Chef" is stated to be the main cause of disappointingly poor results for the year ended 31 July last. The board have deferred paying the half-yearly Preference dividend. The machine tool, expected in January, was not installed until late in April, so that quantity production was not reached until June. The credit squeeze has also affected domestic appliance sales and it has taken longer than expected to bring the Peerless and Ericsson division to the profit-making stage, Mr J. H. Senior, chairman, reports. Trading improved in the past three months.

Palestine Electric Corporation

Profit for the year ended 31 March last is I£4,388,039 (*I£3,115,408*) after local tax.

Pifco Holdings

After charging tax and depreciation, net profit for the year to 30 April is £115,534 (*£109,317*), and total distribution is raised 5% to 30%, with a final dividend of 20%.

Sterling Cable Co. Ltd.

With group net profit for the year to 31 March last down to £28,501 (*£64,027*), after tax, the dividend is cut to 6½%, against the equivalent of 10 6/7% last time. Mr J. S. Clark, chairman, reports that the order book is larger than ever and, although prices are not yet entirely adequate, he believes this year will show a return to fair margins.

L. Sterne and Co.

This refrigerating equipment firm is raising nearly £1 million in an issue of new 5s Ordinary shares offered at 25s each on a one-for-five basis. The directors forecast a final dividend of 12½% on the increased capital and point out that although turnover is substantially greater than for the previous year, profits are at a lower level. It is estimated that the current year's profit is likely to be about £550,000 compared with £675,000 for the year ended 31 Oct., 1959. But prospects for further orders are good and the directors anticipate a satisfactory level of output and earnings during the next year.

Vactric Ltd.

With a group trading loss of £122,069 for the year to 26 March last, after charging depreciation and £179,159 for bad debts, there is no final Ordinary dividend and the Preference dividend due on 30 Sept. is passed. The directors attribute the trading loss entirely to the domestic appliance business, but conditions have worsened with the imposition of h.p. controls since the end of the period covered by these accounts. The board adds that substantial stocks of appliances are accumulating and the group's financial resources are strained to the limit. Every effort is being made to restore profitable trading in this section of the business and to overcome the immediate difficulty of the group's cash requirements which is causing anxiety. The one bright spot is that Vactric (Control Equipment) Ltd. and Vactric (Precision Tools) Ltd. made a profit.

Dividends Declared

Aberdare Holdings. Interim 7½% (*same*).

Advance Components. Interim 7½%.

Bowthorpe Holdings. Interim 7% (6%).

John Thompson. Interim 5% (7½%).

C. A. Parsons and Co. Interim 10½d per share (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

22 Sept.—Barnstaple B.C. (b) Electrical work in house improvements at Mill and Pottengton Rds.—See 15 Sept. issue.

22 Sept.—Lancs C.C. Supply of lamps, tubes, clocks, cookers, drying cabinets, experimental power units, fans, fires, food mixers, fluorescent fittings, fume cupboards, hand lanterns, irons, kettles, lighting fittings, petrol pumps, pottery kilns, radios, refrigerators, cold rooms, sewing machines, stage lighting equipment, vacuum cleaners, wash boilers, washing machines, water heaters and television sets for one year.—See 15 Sept. issue.

23 Sept.—Lowestoft B.C. Electrical installations in 50 houses on Gunton estate. Borough Engineer, High St. Deposit £1 1s.

23 Sept.—Maidstone B.C. Supply and erection of two 125 g.p.m. and two 200 g.p.h. centrifugal sludge pumps complete with motors and control gear.—See 15 Sept. issue.

23 Sept.—Peterborough T.C. Lighting and power installation in four shops/two flats/three maisonnettes on Gunthorpe estate.—See 15 Sept. issue.

24 Sept.—Laois C.C. (a) Supply and installation of built-in cold room; (b) delivery and supply of steam and electric cooking equipment; and (c) rewiring electric lighting and service socket installation at County Hospital.—See 1 Sept. issue.

26 Sept.—Colne Valley U.D.C. Supply of 400 80 W and 270 400 W m.v. lamps.—Advertised 15 Sept. issue.

26 Sept.—Cornwall C.C. (b) Electrical services sub-contract on fixed-price basis for Camborne Police Station. Applications to County Architect, County Hall, Truro, by above date.

26 Sept.—Liverpool C.C. Supply of lamps for supplies list. Central Purchasing Officer, New Oxford Hse, 75 Dale St, Liverpool 2.

26 Sept.—Orpington U.D.C. Supply of Group "B" concrete street lighting columns and brackets—See 1 Sept. issue.

26 Sept.—Wem R.D.C. Installation of electricity at six council houses in Ash Whitchurch.—See 1 Sept. issue.

28 Sept.—Durham C.C. (a) Electrical installation in adaptations and extensions at Ryhope Robert Richardson Grammar School. Applications to County Architect, South St, Durham, by above date.

28 Sept.—Hull C.C. (a) Electrical installation in Central Library extension. City Architect, Guildhall. Deposit £2, payable to City Treasurer.

29 Sept.—Batley B.C. Supply of tungsten and discharge lamps.—See 15 Sept. issue.

29 Sept.—Epping U.D.C. Street lighting included in fixed-price tender for making up of Nicholls Rd (part).—See 15 Sept. issue.

3 Oct.—Droitwich B.C. Supply, delivery and erection of 24 steel lighting columns, 25 ft, and five tubular steel brackets with 250 W colour-corrected mercury discharge lamps.—Advertised 8 Sept. issue.

3 Oct.—East Linton. Electrical work for S.E. Fire Brigade in New Brown's Pl fire station.—See 8 Sept. issue.

3 Oct.—Featherstone U.D.C. Contract 2. Supply (nominated manufacturer) and installation of 60 250 W and 117 125 W mercury fluorescent and 30 85 W sodium vapour lighting units together with 25 and 20 ft reinforced concrete columns/control gear/erection/equipment wiring. Supply only of 197 60 W sodium lighting and control gear. Engineer and Surveyor, Town Hall, Featherstone, Yorks. Deposit £2 2s.

3 Oct.—Manchester C.C. Electrical installation in photographic, fingerprint, etc., sections at St. Joseph's Police Bldgs, Longsight. City Architect, P.O. Box 488, Town Hall.

3 Oct.—N.I. Hospitals Authority. Supply of three floor polishers/scrubbers, four heavy duty vacuum cleaners and one heavy duty dish-washer. Secretary, Tyrone and Fermanagh Hospital, Omagh.

6 Oct.—Belfast C.C. Lift installations in proposed College of Art. Education Architect's Dept., 40 Academy St, Belfast 1.

6 Oct.—Cardiff C.C. Erection of 1,260 Class "B" concrete columns and complete installation of 80 W mercury lanterns/gear, on fixed-price basis, contract 6. City Surveyor, City Hall. Deposit £2 2s.

7 Oct.—Dun Laoghaire. Supply and erection of two 3½ ton cranes.—See 15 Sept. issue.

7 Oct.—Ilkley U.D.C. Supply, erection and putting into service of 3,100 yd of 400 W colour-corrected mercury m.v. lighting on steel columns complete with control gear, fuses and brackets for A65 lighting.—See 15 Sept. issue.

7 Oct.—Southport B.C. Electrical installation at Floral Hall.—See 1 Sept. issue.

8 Oct.—Chilton P.C. Supply of 21 sodium vapour and ten tungsten lamps/brackets/gear for trunk road lighting.—See 15 Sept. issue.

8 Oct.—Haslingden B.C. Rewiring of power circuits in 44 houses, Free La, Helmshore, and Cedar Ave, Haslingden.—See 15 Sept. issue.

8 Oct.—Ilkley U.D.C. Rewiring of 28 houses at Menston. Engineer and Surveyor, Chantry Drive.

8 Oct.—North Witchford R.D.C. Contract 2. Supply and erection of duplicate 100 g.p.m. sludge pumps. Contract 3. Supply and erection of duplicate 20 g.p.m. and duplicate 100 g.p.m. ejectors all complete with motors, starters and accessories.—See 15 Sept. issue.

10 Oct.—Armagh C.C. Electrical installation in Keady County Secondary Intermediate School.—See 15 Sept. issue.

10 Oct.—Bristol C.C. Supply and erection of dual fuel sludge gas/diesel engine alternators, 750 b.h.p./525 kW at 3·3 kV 3-ph., together with associated waste heat recovery plant, switchboards, switchgear, transformers and cables. Applications to City Engineer and Planning Officer, Cabot Hse, Deanery Rd, Bristol 1, by above date.—Advertised in this issue.

10 Oct.—Camberwell B.C. Provision of Group "A" 200 W sodium lighting on steel columns in place of existing lighting: A221, six 140 units (112 new, 28 retained); A2208, 12 units (nine new, three retained). Replacement on existing columns: A2, 70 units; A202, 108 units; A215, 98 units. Borough Engineer and Surveyor, Town Hall, S.E.5.

10 Oct.—Thorney P.C. Erection of 19 Group "A" steel columns and 140 W sodium lanterns/equipment. Clerk: E. Searle, The Green, Thorney, near Peterborough. Deposit £2.

13 Oct.—Northwich R.D.C. Supply and erection of 206 Group "B" 15 ft concrete columns, 290 lanterns/control gear and resiting of existing columns. Engineer and Surveyor, Whitehall, Hartford, Northwich. Deposit £2 2s.

13 Oct.—Warrington R.D.C. Provision and installation of Class "B" lighting standards in various parishes.—See 15 Sept. issue.

14 Oct.—Belfast C.C. Supply of vertical fluorescent street lighting lanterns and brackets. Specification W179 from Electricity Dept., East Bridge St, Belfast 1. Deposit £1 1s.

14 Oct.—Glasgow C.C. Supply of 450,000 yd p.v.c. aerial cable.—See 15 Sept. issue.

18 Oct.—Fylde Water Board. Garstang Borehole scheme: (a) two ¾ m.g.d. 170 ft head; (b) two surface pumps, 1 and 1½ m.g.d. at 320 ft; (d) cables; (e) switchboard. Engineer to the Board, Sefton St, Blackpool.

25 Oct.—Ealing B.C. (a) Supply of 88 140 W sodium lanterns/lamps/gear; (b) supply and erection of 85 25 ft steel columns.—Advertised 15 Sept. issue.

No date stated—Angus C.C. Supply and installation of two electrically driven centrifugal pumps, 175 ft total head.—See 8 Sept. issue.

No date stated—Durham C.C. Electrical installation at E. F. Peile Convalescent Home, Shotley Bridge, Swalwell Fire Station and Durham Fire Station.—See 1 Sept. issue.

No date stated—Kent C.C. Supply and erection of four 35 ft steel lighting columns, supply and fitting four 200 W sodium discharge lanterns and auxiliary electrical equipment at Borstal Hill Roundabout, Thanet Way, Whitstable.—See 8 Sept. issue.

No date stated—Metropolitan Water Board. Applications invited for inclusion in list of tenderers for supply and services as follows: accumulators, motors, alternators, h.t. and l.t. switch and control gear, transformers, rectifiers and accessories. Electrical installation work and cable laying.—Advertised 1 Sept. issue.

No date stated—Redcar B.C. Installation of telephone intercommunication between warden's house and 82 old people's bungalows, Severn Rd.—See 1 Sept. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Sepi-Diacrom" contact cleaning sticks—agents for? S.P.—S. Guiterman and Co. Ltd., 37 Soho Sq, W.1.

"Selectrobo" control units—makers of? T.B.—Manlove Alliott and Co. Ltd., Norton St, Radford, Notts.

"Rowe" convector heaters—makers of? T.W.B.—Rowe Bros. Ltd., Pall Mall, Liverpool.

"Jeani" lamp switches—makers of? J.K.B.—Fitzgibbon and Murray Ltd., Smallfield Wks, Horley, Surrey.

"Briticent" socket-outlets—makers of? F.W.J.E.I.—British Central Electrical Ltd., 6-8 Rosebery Ave, E.C.1.

"Etronic" radio receivers—address for spares? A.B.—R. Barden, 193 Mare St, E.8.

"Norvac" vacuum cleaners—distributors of? S.P.—Norvac Electrics Ltd., 186 Greengate, Manchester 3.

"Inferation" clothes dryers—makers of? M.A.—Inferation Ltd., York Town Industrial Estate, Camberley, Surrey.

"Chalex" drying cabinets—makers of? B.O.D.—C. Hounslow and Co. Ltd., Chalex Wks, Southwick, Sussex.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

27 Sept.—Italy. N.A.T.O. Infrastructure contract: telegraph and telephone installations, value over £1,300, on six sites. Notifications to General Division, B.o.T., Room 5375, Horse Guards Ave, S.W.1. B.o.T. (GD.1472/60/47).*

29 Sept.—Salvador. 2,000 48 in. 40 W daylight type fluorescent tubes. La Proveeduria General de la Republica, Avenida Espana 613, San Salvador. B.o.T. (ESB/24121/60).*

3 Oct.—Greece. Insulators, five items. Offices of State Procurements Service, 50 Socrates St, Athens. B.o.T. (ESB/24101/60).*

3 Oct.—Pakistan. 50 tons each of 3/·147, 7/·136, 6 s.w.g., and 8 s.w.g. h.d. bare copper wire and 5 tons 14 s.w.g. soft copper. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24055/60).*

5 Oct.—Burma. 300 2·5 A 230 V s.ph. kWh meters. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/24656/60).*

5 Oct.—Pakistan. 9,000 galvanised tubular steel line poles and guy rods. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24057/60).*

6 Oct.—India. 320 33 kV, 1,320 11 kV and two 3·3 kV air-break switches. Electrical Superintending Engineer, Central Technical Circle, Bihar State Electricity Board, Patna. B.o.T. (ESB/24152/60).*

6 Oct.—India. 109 11/·415 kV, 500 kV, 750 kV and 1,000 kV outdoor distribution transformers. Tender date: 24 Oct: 200, 300 and 400 kVA transformers. Tender date: 10 Nov.; 25, 50 and 100 kVA transformers as above. Patiala Division, Punjab State Electricity Board, Patiala. B.o.T. (ESB/24125/60).*

6 Oct.—Spain. Radio telephone equipment and on-load sectionalising switches 46 kV 600 A, mounted on 3-ph. disconnect switches. Iberduero S.A., Arlaban 5, Madrid. B.o.T. (ESB/24186/60/ICA).*

8 Oct.—Pakistan. Ten miles 3-core 11 kV earthed self-supporting aerial cable with aluminium conductors and joint boxes. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24052/60).*

8 Oct.—Pakistan. Seven items 500 V ironclad switches from 15 to 300 A. Chief Engineer, Electricity, W.A.P.D.A., Gardi Trust Bldg, Old Anarkali, Lahore. B.o.T. (ESB/24199/60).*

10 Oct.—Spain. Automatic regulators, protectors for 3-ph. machines and transformers, speed regulators, selective protectors for 55 kW grid. Sres. Electra Del Viesgo S.A., Juan de Mena 6, Madrid. B.o.T. (ESB/24187/60).*

12 Oct.—Pakistan. 10,010 h.s. and 3,800 industrial kWh meters. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24053/60).*

13 Oct.—Pakistan. Eleven items of cables. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24056/60).*

15 Oct.—Pakistan. 69 voltage and 48 current transformers. Director of Purchase (E.P. W.P.D.A.), D.I.T. Bldg, Dacca. B.o.T. (ESB/24050/60).*

16 Oct.—Kuwait. Distribution feeder pillars. Dept. of Electricity, Water and Gas, Kuwait. B.o.T. (ESB/24184/60).*

17 Oct.—Australia. 23 6·6 kV transformers. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/24438/60).*

18 Oct.—Argentina. Estimated 20·1 million pesos extension, Dolores Power Station. Ministry of Public Works, Province of Buenos Aires. B.o.T. (ESB/24086/60).*

21 Oct.—India. Stranded copper busbars of 0·3 and 0·5 sq in. Chief Engineer, Kerala State Electricity Board, P.B. 65, Trivandrum 1. B.o.T. (ESB/24058/60).*

22 Oct.—Pakistan. One 1·5 MVA 66/33 kV transformer. Electricity Dept. (W.P.D.A.), Construction Division, Nowshera. B.o.T. (ESB/23768/60).*

28 Oct.—Chile. Six items diesel-electric or diesel-hydraulic locomotives including 29 of 1,200 h.p. and 49 of 600 h.p. Jefe del Departamento de Traccion y Maestranzas, Ferrocarriles del Estado de Chile, Al. B. O'Higgins 934, 3° Piso, Santiago. B.o.T. (ESB/5900/60).*

28 Oct.—South Africa. 44 four-ton wharf cranes. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (ESB/20729/60).*

31 Oct.—India. Control cables for Sumer Power Hse of Umiam (Barapani) H.E. Project. Additional Chief Engineer (Electrical), Assam State Electricity Board, Lachumiere, Shillong, Assam. B.o.T. (ESB/24151/60).*

2 Nov.—Chile. Complete installation of Huasco thermal power station of two 7·5 MW steam drive turbo sets and condensers, cooling plants, switchgear, etc. ENDESA, Ramon Nietnto 920 Santiago. B.o.T. (ESB/2193/60).*

2 Nov.—India. 50 11 kV and 20 22 kV automatic reclosers. Chief Engineer for Electricity, Madras State Electricity Board, 157 Mount Rd, Madras 2. B.o.T. (ESB/24059/60).*

2 Nov.—India. 429 miles of underground telephone cable. Director-General of Supplies and Disposals, Shajahan Rd, New Delhi. B.o.T. (ESB/24159/60).*

15 Nov.—India. Feed water heaters for Chandrapura thermal power station. Government of India, India Supply Mission, 2536 Massachusetts Ave, N.W., Washington 8. B.o.T. (ESB/24173/60/DLF).*

27 Nov.—Iraq. Portal wharf cranes, two 15 tons, two 8 tons and 12 3 tons. Office of the Mudir, Purchase and Tender, Iraqi Ports Administration, Basrah. B.o.T. (ESB/23787/60).*

TRADE NOTES

Agents. The Sofono Electrical Division of Federated Foundries Ltd. announce the appointment of two new agents: Baker, Duthie and Co. Ltd., of 131 West Regent St, Glasgow C.2, to handle Sofono electrical appliances for the whole of Scotland; and Adco Distributors (N.I.) Ltd., of 23 Great Patrick St, Belfast 1, to handle them in Northern Ireland. Baker, Duthie and Co. Ltd. were until recently Scottish agents for Morphy-Richards.

BEAMA Contract Price Adjustment Formulae. *For Electrical Machinery and Equipment.* For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 16 Sept., 1960, shall be deemed to be 204s 6d; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 16 Sept., 1960, is 117·0* (181·5*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 16 Sept., 1960, shall be deemed to be 204s 6d; (*b*) "Cost of Material"—the index figure for Materials used in the Mechanical Engineering Industry at 16 Sept., 1960, is 126·4* (189·9*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)," 189·5*. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2), 129·1*. The price of brass condenser tubes ¾ in. o/d 18 s.w.g. on 16 Sept., 1960, is 4s 0¼d per lb. *Provisional figure.

The figures in parentheses shown above relate to the earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954 = 100.

Belfast office. Albright and Wilson (Mfrs.) Ltd. have opened a sales office at Imperial Bldgs, 72 High St, Belfast (telephone: Belfast 32312, where Mr W. Kerr is in charge.

Birmingham office. On 26 Sept. Westool Ltd. are opening a new office at Silhill Hse, 2241 Coventry Rd, Sheldon, Birmingham 26. Telephone: Sheldon 5121-2.

Change of Address. The Sales and Service Departments of the English Electric Co.'s East Midlands Domestic Appliance Division has moved to De Montford Hse, Belgrave Gate, Leicester. Telephone: Leicester 23166.

London office. As from 3 Oct. Heatrae Ltd. are to open a new London office at Norwich Hse, Southampton Pl, W.C.1. Telephone: Chancery 4114. The office will be under the personal control of Heatrae's London director, Mr E. S. Chisholm. The office at Kenton will cease to operate.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Biclor. 805,701. Class 9. Capacitors impregnated with chlorinated diphenyl. British Insulated Callender's Cables Ltd., Norfolk Hse, Norfolk St, W.C.2.

Catu C Paris in design. B790,479. Class 9. Apparatus, etc. Etablissements Catu, 54 Rue due Faubourg, due Temple, Paris XIe, France.

Conyflaker. 804,851. Class 7. Tension-imparting machines for use in unwinding wire, etc. Connollys (Blackley) Ltd., Blackley Vale Mills, Manchester 9.

Dryday. 796,711. Class 7. Domestic tumbler dryers. 799,321. Class 11. Drying cabinets and installations. Wallisdown Electrical Appliances Ltd., Wallisdown Rd, Winton, Bournemouth.

Mobylmaid in design. 803,471. Class 11. Mobile dish-washing machines. Scotts Eng. (Newport) Ltd., 59 Stafford Rd, Newport, Mon.

Paragon Phoenix in design. B797,831. Class 9. Batteries. Motor and General Factors Ltd., 170-173 Commercial Rd, Newport, Mon.

Phastronic. 799,875. Class 9. A.C. voltage regulators incorporating semi-conductor devices. Westinghouse Brake and Signal Co. Ltd., 82 York Way, King's Cross, N.1.

Sheerlock. B796,623. Class 7. Clothes washing, ironing and dish-washing machines; waste pulverisers, etc. General Motors Corpn., West Grand Boulevard and Cass Ave, Detroit, Michigan, U.S.A.

Snowcharm. B799,040. Class 9. Refrigerators and refrigerating installations, etc. H. S. Moss (Chorley) Ltd., Moor Rd, Chorley, Lancs.

Uniclare. 802,549. Class 9. Transistors, etc. C. P. Clare and Co., 3101 Pratt Boulevard, Chicago, Illinois, U.S.A.

Warmalee. 803,796. Class 11. Undercarpet heaters. Marpat Mnfg. Ltd., 113 High Holborn, W.C.1.

CONTRACTS PLACED

British Railways. Wiring of 85 houses at North Blyth, J. W. Potts.

Cannock U.D.C. Group "A" lighting along B5013, Hednesford, and Group "B" scheme for various roads, Engineering and Lighting Equipment Co., £1,914.

Gillingham B.C. Supply of transformers, capacitors and lamps for 140 W sodium lighting, Abacus Municipal Ltd.

Ilford B.C. Provision of Stage III street lighting, Penmar and Co. Ltd., £12,926. Recommended.

Sunderland T.C. Supply of 146 25 ft and 78 19 ft columns, Concrete Utilities Ltd.; 190 totally enclosed sodium lanterns, Engineering and Lighting Equipment Co. Ltd.

York. Installation of new lighting fittings at Assize Courts, House and Son Ltd., £837 13s 6d.

BUSINESS PROSPECTS

Abergavenny. Thomas and Morgan and Ptnrs, 23 Gelliwasted Rd, Pontypridd, architects for Coopers Mechanical Joints' planned extensions to Llanfoist Works.

Accrington. Barclays Bank (premises dept.), 42 Gracechurch St, E.C.3, plan rebuilding at 5 Union St.

Acton. W. R. Craig and Co., Palmerston Rd, W.3, plan three-storey factory on Bollo La site.—W. J. Lewis and Son, 68 Cranbrook Rd, Ilford, Essex, architects for F. Meyers' warehouse block, Western Ave.

Aldershot. Land to be released by M. of Health to W.O. for proposed 600-bed hospital.

Barnstaple. Ayers and Grimshaw, 3 Bickington Rd, Barnstaple, plan two-storey office block of 35,000 sq ft.

Barrow-in-Furness. Manchester Hospital Board, Cheetwood Rd, plan operating theatres, Roose Hospital, and ward block at Victoria Hospital.

Bath. Griggs and Son, 56 Victoria St, S.W.1, contractors for £295,604 extensions at Newton Park Training College.

Bishopstoke. Upgrading of buildings and extensions to "A" block at Mount Sanatorium planned.

Bracknell New Town. Foreman and Lockyer, Old Bank Chmbrs, High St, architects for Premier Precisions Ltd. planned extensions.

Bridgnorth. Birmingham Hospital Board, Edgbaston, plan X-ray dept. at Bridgnorth and South Shropshire Infirmary.

Bristol. Imperial Tobacco Co. to build 60,000 sq ft factory on Bristlington Trading Estate for Mardon, Son and Hall.—Hardwick Bros. (Bristol), Newfoundland Rd, plan factory and office extensions.—B. Lowe, 8 Queen Sq, architect for development of York Rd site for Morrison Confectionery.—Bristol Typesetting Co., 41 Stokes Croft, plan buildings on 1,142 sq yd York St land.—D. G. Pepperell, 25 Clare St, architect for Broadway (Bristol) Engineering factory.—F. L. Cottle, 1 Heyford Ave, architect for Bristol Wafers Ltd. factory.—J. A. Harper and Son, 63 Temple Row, Birmingham, architects for Bell and Nicholson extensions.—D. R. McGill, 26 Broad Quay, architect for Wiltshire (Bristol) Ltd. printing factory and offices.—William F. Johnson, Oak Hse, Bridge End, Warwick, architect for University of Bristol's School of Chemistry.

Burnley. Joseph Lucas Ltd. plan development of 14¼ acres Eastern Ave land for industrial building.—The Prestige Group, 14 Holborn, E.C.1, plan factory extensions, Colne Rd.—Burnley Investments Ltd. plans shop, offices, social club, etc., Parker La, Red Lion St.

Bury. Manchester Hospital Board plan upgrading of wards, etc., Fairfield General Hospital.

Chester. S. Roth, Tetley and Felce, 3 Little London, architects for £110,000 building in East St for Barclays Bank Ltd.

Chesterfield. T.C. plans street lighting improvements on main Sheffield-Derby road. Engineer.

Co. Durham. Clayton and Deas, High Row Chmbrs, Darlington, architects for primary school, High Coniscliffe.

Colchester B.C. Tender: Administration block. Baker and Burton, 3 Church St, Colchester, architects.

Countesthorpe (Leics). P.C. plans 20 street lamps on new Leicester Rd estate.

Coventry. Boilers (Coventry), 25 Ford St, plan factory and office premises, Torrington Ave.—Gosford Tool and Equipment, 310 Broadgate Hse, plan Torrington Ave factory extensions.—H. A. Smith and Son, Whitefriars Press, Burnsall Rd, plan factory extensions.—E. Laxon and Co., Gas St, plan Charter Ave warehouse.—Roman Catholic Diocesan Trustees to buy additional land near Corpus Christi Primary School as a convent.

Darlington. Sanderson, Townend and Gilbert, 92 Bondgate estate, agents on behalf of C. W. Jackson, plan 1,380-dwelling scheme at Mowden.

Dartford B.C. Tender: 29 flats, four houses, six shops, on sites 3G and 6 in the Temple Hill Neighbourhood unit. Town Clerk.

Dewsbury B.C. Tender: 82 dwellings, Thornhill Lees redevelopment. Architect.

Durham. C.C. plans £5,000 conversion of rural domestic centre, Houghal, to laboratories for students. Architect.—Five police houses planned by C.C. at Whickham St, Easington Colliery.—C.C. Tender: Cleadon Junior School, Hare Law New Day School, Peterlee, Shotton Hall New Modern School, etc. Also installation of heating and hot water accelerators at Nevilles Cross Training College. Clerk, Shire Hall, Durham.

Easington R.D.C. 50 dwellings planned at Peterlee. Surveyor.

East Sussex C.C. Tender: Assembly halls, kitchen, gymnasium and changing and shower accommodation, Lewes Secondary School. Architect, Lewes.

Eccles. C. S. Allott and Son, 1 North Parade, St. Mary's Parsonage, Manchester 3, consulting engineers for additions, etc., at Victoria Mills for Scottish Brewers Ltd., Abbey Brewery, Holyrood Rd, Edinburgh 8.—R. D. Moor plans factory extensions at 1a Andover St.

Edinburgh. Dean of Guild Court approves extension plans, Royal Edinburgh Hospital for Mental Disorders, Morningside Pl, at cost of £½ million. S.E. Regional Hospital Board's own architect.—14-storey arts building at corner George Sq planned by University at £½ million.—Ferranti plan £50,000 extensions to Ferry Rd premises.

Exeter. Basil Spence and Ptnrs, 1 Canonbury Pl, N.1, architects for £1 million University lecture and science buildings.

Farnworth. Murrayfield Real Estate Co., 62 St. James's St, S.W.1, to submit scheme for redevelopment of town centre.

Glasgow T.C. Tender: reconstruction of Govan refuse disposal works including assembly of electrical control equipment, water, fire, heating and electrical services. Director of Cleansing, 235 George St, Glasgow.

Halifax. Bond, Foster and Ptnrs, 19 Hertford St, Park La, London W.1, quantity surveyors for £1 million buildings at Albion Mills planned for J. Mackintosh and Sons.

Haltwhistle. Smith and Walton Ltd., Hadrian Varnish Works, plan factory extensions.

Harlow New Town. J. Longley and Co., Crawley, Sussex, contractors for Colora Printing Inks Ltd. new factory.

High Wycombe. Thurlow, Lucas and Janes, 86 Easton St, architects for £40,000 office block/canteen for Broom and Wade.

Isleworth. Howard Farrow, Highfield, N.W.11, contractors for £77,000 Gillette Industries buildings, Gt. West Rd.

Jarrow. Smart and Brown (Machine Tools), Biggleswade, Beds, plan factory.

Kendal. Tender: Restoring and converting Abbot Hall into art gallery centre. Architect: M. Bunney, 30 Lowther St.

Liverpool T.C. Tender: Altering and extending lifts at Police H.Q., Hardman St. Engineer.—Notre Dame R.C. secondary school for girls planned, Stonebridge La.

London. Marshall Taplow, Whitehall Distillery, 71 Leytonstone Rd, E.15, plans factory and offices. Architects' dept., Charrington and Co., 86 Fenchurch St, E.C.3.—Living and Son, 2 Romford Rd, E.15, architects for Johnstone and Cumbers Ltd. planned extensions at Sugar Loaf La, E.15.—Carnegie Models, 68 Gt. Portland St, W.1, plan 52,000 sq ft factory on Osborne St, E.1, site.—Halse and Sons, 80 High St, Woolwich, S.E.18, contractors for £24,000 factory, Cowcross St, E.C.1.—Courtney and Fairbairn, 377 Albany Rd, S.E.27, to erect £20,000 printing works, etc., Spa Rd, Bermondsey, S.E.1.—L. C. Norton, 4 St. George St, Hanover Sq, W.1, architect for E. and R. Thomas Ltd. planned industrial building at Bondway, Vauxhall, S.W.9.—Bernard Sunley Investment Trust, 25 Berkeley Sq, W.1, plan multi-storey building on Cooper's Row site, E.C.3.—B.P. Co., Britannic Hse, Finsbury Sq, E.C.2, plan 32-storey building by Moorgate St station. Architect: F. Milton Cashmore (of Joseph), 3 (North) King's Bench Walk, E.C.4.—Campbell-Jones and Son, 9 Dowgate Hill, E.C.4, architects for King St and Ironmonger La junction office block.—Wimperis, Simpson and Fyffe, 61 South Molton St, W.1, architects for shops and offices at 72 Euston Sq and Eversholt St, N.W.1.—Erno Goldfinger, 69 Piccadilly, W.1, architect for 17-storey block flats, Avenue Rd, N.W.8.

Manchester. C. E. Chaplin and Co. plan Duke St factory extensions.—Two further floors planned at Midland Hotel by B.T. Hotels and Catering Services, St. Pancras Chmbrs, Euston Rd, N.W.1.

Middlesbrough T.C. Tender: 32 Easterside houses. Engineer.

Middleton. Reynolds and Scott, 9 Albert Sq, Manchester 2, architects for extensions to De Salle Teachers' Training College, Hopwood Hall.

Nailsworth. Education Committee plans £105,275 secondary modern school.

Newcastle C.C. Welfare Centre with flats above at Fenham Hall Drive. Architects: Ryder and Yates, Churchill Hse, 87 Jesmond Rd.—School planned at Freeman Rd for 450 pupils. Diocesan Director of Education, Canon P. M. Martin, 50 Two Ball Lonnen.

Northallerton. Hospital Management Committee plans twin operating theatres, at £50,000, in Friarage Hospital. Newcastle Regional Hospital Board's own architect.

North Riding. Stage two of C.C.'s school building programme covers six schools at a total cost of £342,328.—C.C.: Branch library at Haxby planned.

Northumberland C.C. £35,000 health centre planned. Architect.

Nottingham T.C. Tender: Police Operational Centre, Queen's Drive. Engineer.

Peterborough. East Anglian Hospital Board, Cambridge, plans out-patients' and casualty departments, Alderman's Drive.

Oldham B.C. Tender: 72 houses, 20 two-storey flats and 14 bungalows at Flitton Hill estate. Chartered quantity surveyors: Cameron and Middleton, 21 Queen St, Oldham.

Reading. A.A., Leicester Sq, W.C.2, plan £50,000 extensions to Fanum Hse. Architects: Sainsbury and Chamberlain, 14 Cross St, Reading.

Redcar. 24 shops with maisonnettes planned by T.C. connected with Lakes housing project. Also library, clinic and community hall. Architect: F. Gibberd, 8 Percy St, W.1.

St. Asaph. Ega Electric, Holyhead Rd, Wednesbury, Staffs, plan factory.

St. Ives (Hunts) B.C. Tender: 28 bungalows, Cemetery Rd. E. Price Lavender, Crown Yard, St. Ives.—T.C.: 30 houses planned. Surveyor.

Scarborough. T.C. plans rewiring of 170 houses on Northstead estate at £6,090. Engineer: V. Forshaw, Town Hall.

Shrewsbury. New General Hospital planned adjacent to present Copthorne Hospital, possibly with 100-bed maternity unit.

Southampton. Royal South Hants Hospital planned with about 350 beds and General Hospital of about 570 beds at a total cost of £1,300,000.—Wessex Regional Hospital Board, Romsey Rd, Winchester, authority for £100,000 Stage 2 of Pathological Laboratory services.

South Shields. Mary Harris, Team Valley estate, Gateshead, plan extensions at John Clay St works which will double manpower.

Sunderland. Leslie and Co., Woodland Rd, Darlington, contractors for five-storey shop at Borough Rd for Binns Ltd.—W. S. H. Julian, 252 High Holborn, W.C.1, surveyor for shops and offices at Holmeside for Pearl Assurance.—C. T. Brown and Son, 14

Business Prospects—Continued

Grange Terr, Stockton Rd, architects for carpet cleaning depot at Back Rossley St for Northern Laundry.—T.C. to obtain tenders for students' union and hostel block at South Johnson St. Borough Architect.—Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, plan factory extensions at Pallion for Industrial Estates Corporation of England.

Sutton and Cheam B.C. Tender: New branch library of 5,700 sq ft. Town Clerk.

Swansea B.C. Tender: Branch Library, Pentrepoeth Rd, Morriston. Architect.

Washington U.D.C. 125 houses planned. Surveyor: T. E. Crowe.

Whitley Bay. Solomon, 30 St. Mary's Pl, Newcastle, architect for bank and three flats in Front St.—J. V. Spencer, 171 Albert Rd, architect for 27 Haddon Green dwellings.—Child welfare centre, Whitley Lodge estate, planned. County Architect.

Worcester T.C. Tender: 108 dwellings, Warndon estate. Engineer.—Ten dwellings, Powell's Row Development Area, St. John's. Engineer.

Yeovil B.C. Tender: 42 houses and 12 bungalows. Surveyor.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

John Baggs Electric Ltd., Relay Wks, Hollins Rd, Oldham. To take over business of electrical and general engineers carried on at Relay Wks, Station Rd, Uppermill, nr. Oldham, as John Baggs and Co., etc. Nom. cap.: £10,000. Dirs.: John Baggs and Celia Baggs.

Bond Electric Ltd., 850 Wimborne Rd, Bournemouth. Nom. cap.: £10,000. Dirs.: H. W. Bond, Mrs D. I. Bond and W. L. Edgar.

R. V. Burnett (Electrical Contractors) Ltd., 139 Church Rd, Burgess Hill, Sussex. Nom. cap.: £1,500. Dirs.: Robert V. Burnett, S. W. Taylor and D. J. Townings.

Combined Electrical Manufacturers Ltd. Nom. cap.: £100. Dirs.: not named. Subs.: G. L. Law and G. B. Inglis, 18 Austin Friars, E.C.2.

Durham Electricals (Wholesalers) Ltd., 56 Millburn St, Crook, Co. Durham. Nom. cap.: £1,000. Dirs. George Dobson and Gertrude M. Dobson.

Emandelle Electrical Products Ltd., 57 Blandford St, W.1. Nom. cap.: £100. Dir.: Seymour Cooper.

Evton Products Ltd., St. John's Chmbrs, Love St, Chester. Manufacturers and distributors of all types of electrical and mechanical products, etc. Nom. cap.: £1,000. Permanent dirs.: Arthur J. Evans, Charles A. Hinton and Albert W. Hinton.

Jack Gay Ltd., 3 Cavendish Parade, Bath Rd, Hounslow, Middx. Manufacturers of and dealers in domestic household and general electrical, photographic equipment, etc. Nom. cap.: £2,000. Dirs.: Jack Gay and Paul G. Golf.

Gulton Industries (Britain) Ltd., 9 Drapers Gdns, Throgmorton Ave, E.C.2. Manufacturers of and dealers in electrical and electronic equipment, etc. Nom. cap.: £100. Dirs.: Leslie K. Gulton and David Barr.

T. Hannay Ltd., 20 Princess St, Manchester 1. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Thomas Hannay, Joseph McDonough and Godfrey McDonough.

S. R. Harding (Electrical Wholesale) Ltd., 40 Costin St, Bedford. Nom. cap.: £5,000. Permanent dirs.: Stuart R. Harding, Edith I. Harding and Gordon H. Gentle.

H.T. Electrical Ltd., Kings Wks, off Stallings La, Kingswinford, Staffs. Nom. cap.: £1,000. Dirs.: Jack B. Hickman, Doylah E. T. Tanfield, Horace E. Richardson and Julius Torbe.

Lampclean Ltd. Cleaners of lamps and lighting equipment, etc. Nom. cap.: £200. Dirs.: Owen C. Nye, 24 Julians Rd, Stevenage, Herts; and Kenneth Smith, 65 Pinner Hill Rd, Pinner, Middx.

Miller Kent Decoratives Ltd., 39-40 Devonshire Chmbrs, 146 Bishopsgate, E.C.2. Manufacturers and distributors of decorative displays, etc. Nom. cap.: £2,000. Dirs.: Louis Simmonds, Mrs Sallie Simmonds, Anthony I. Simmonds and David H. Simmonds.

Robuk Electrical Industries Ltd., 126 Bishopsgate, E.C.2. Nom. cap.: £2,000. Dirs.: Samuel Korobuk and Eric A. Moore.

Rowharder Electrics Ltd., 138-9 Bush Hse, W.C.2. Electricians, etc. Nom. cap.: £100. Dirs.: to be appointed by Subs. Subs.: Michael Claff and Shirley Hart.

Six-Ways Electrical Ltd., 3a Hill Pl, London Rd, Charlton Kings, Cheltenham. Nom. cap.: £1,000. Dirs.: Ronald V. Cox, Alfred S. P. Williams, Mrs Mary K. Cox and Mrs Jean E. Williams.

Gazette Announcements

COMPANIES ACTS

West Lancashire Electronic Products Ltd. and **West Lancashire Radio and Television Laboratories Ltd.** Mr C. Mead, 55 Hoghton St, Southport, appointed liquidator at extraordinary general meeting on 8 Sept. for the purpose of voluntarily winding-up.

Elizabethan Dynamatic Ltd. Mr H. E. Hassell, 8 Queen St, Cheapside, E.C.4, and Mr H. C. Hedges, 4 Charterhouse Sq, E.C.1, appointed joint liquidators at extraordinary general meeting on 7 Sept. for the purpose of voluntarily winding-up.

R.T.E. Ltd., R.T.E. Electrics Ltd., R.T.E. Service Ltd., R.T.E. Factors Ltd. Mr A. W. Hunter, Walter Hse, 418-422 Strand, W.C.2, appointed liquidator at general meeting of creditors on 22 Aug. for the purpose of voluntarily winding-up.

Matlo Electric Eng. Ltd. trading as **St. Albans Domestic Appliance Centre.** Meeting of creditors to be held at 73-78 High Holborn, W.C.1, on 23 Sept., at 12 noon.

Tyne-Tees Electrical Supplies Ltd. Resolution for voluntarily winding-up passed at extraordinary general meeting on 9 Sept. Mr E. Taylor, 30-32 Grey St, Newcastle-on-Tyne, appointed liquidator at subsequent meeting of creditors.

Capel Electrical and Radio Co. Ltd. Mr C. R. Watson, 124 High St, Dorking, appointed liquidator at extraordinary general meeting on 9 Sept. for the purpose of voluntarily winding-up.

BANKRUPTCY ACTS

Receiving Orders

Bolton. N. Pilling, electrical contractor, formerly carrying on business at 48 Bury Rd, Bolton. Receiving order dated 13 Sept.

Barnstaple. G. H. Cornwell, electrical retailer, carrying on business at 21 Rockmount, Pitt La, Bideford. Receiving order dated 12 Sept.

First meeting and Public Examinations

Bradford. J. T. Windle, retailer of electrical goods and furniture, formerly carrying on business as Windle and Pawsey, at 38 Ewart St, Gt. Horton, and at Hollins Hill Hse, Hebden Bridge. Public examination: 10.30 a.m., 14 Nov., at County Court, Manor Row, Bradford 1.

Ipswich. J. S. R. Morley, plumber and electrical engineer, formerly carrying on business in partnership as Morley and Bishop at The Street, Redgrave, Diss. First meeting: 10.30 p.m., 23 Sept., at Room 1, 3 and 5 Northgate St, Ipswich; and public examination: 10.30 a.m., 10 Nov., at The Shire Hall, St. Helens, Ipswich.

Merthyr Tydfil. L. O. Owen, electrical contractor, formerly carrying on business as Beacon Electrical Co., at 9 Maesyrberllan, Trecastle, and previously in partnership at 21 Wern St, Ystalyfera. Public examination: 11 a.m., 28 Oct., Town Hall, Merthyr Tydfil.

Sheffield. C. Roberts, domestic electrical appliance dealer, formerly carrying on business as Andor Electrics, at 27 High St, Doncaster. Public examination: 2 p.m., 8 Dec., at County Court Hall, Bank St, Sheffield 1.

Dividends

Cheltenham. W. Worboys, electrical contractor, formerly carrying on business as Cambrian Electrical Services, at Longford Garage, Tewkesbury Rd, Longford. Dividend per £: 2s 1½d, payable at Official Receiver's Office, 26 Baldwin St, Bristol 1, on 26 Sept.

Kingston upon Hull. P. G. L. Marsh, journeyman electrician, formerly carrying on business as P. G. Marsh and Sons, at 259a Rice La, Bootle. Dividend per £: 5s 2½d, payable at 4 Silver St, Hull, on 27 Sept.

Brighton. F. W. Ames, electrician, of 73 Havelock Rd, Bognor Regis. Dividend per £: 10d, payable at Official Receiver's Office, 8 Old Steine, Brighton 1, on 23 Sept.

MEETINGS TO NOTE

THURSDAY, 22 SEPT.

A.S.E.E. (Southampton). "The Association," E. K. Brittain. Cathedral Hotel, Salisbury. 7.30 p.m.

ELECTRICAL ASSOCIATION FOR WOMEN. "Electricity in the Garden," J. Warren, 25 Foubert's Pl, W.1. 2.15 p.m.

MONDAY, 26 SEPT.

BIRMINGHAM ELECTRIC CLUB. Presidential address: "A Survey of Progress Made in the Development of Domestic Electrical Appliances," J. R. Anderson. Grand Hotel. 6.15 p.m.

A.S.E.E. (N.W. London). "H.R.C. Fuse Protection," E. J. Jacks. Compass Hotel, Watford. 7.45 p.m.

I.E.S. (Birmingham). Chairman's address, B. J. MacCarthy. Regent Hse, St. Phillip's Pl, Colmore Row. 6 p.m.

I.E.E. (N. Staffs Graduates and Students). Chairman's address: "Rectifier Applications," D. J. Andrews. Technical College, Stafford. 7.15 p.m.

TUESDAY, 27 SEPT.

I.E.S. (Leicester). Chairman's address, Corah and Sons Ltd., St. Margaret's Wks. 6.15 p.m.

I.E.E. (Southern Graduates and Students). Chairman's address: "A Review of Modern Computing Elements," R. E. Hayes. Technical College, Farnborough. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY. "Gas Sampling for Automatic Combustion Control," R. Hardy; and "Smoke Density Measurement," G. H. Laycock. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). "Looking at Control Systems with an Analogue Simulator," S. W. J. Wallis. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

WEDNESDAY, 28 SEPT.

B.I.R.E. (Electro-Acoustics). Discussion: "The Land Colour Theory with Particular Reference to its Applications to Colour Television." London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Wales). "Instrument Installation and Maintenance Costs," S. W. J. Wallis. Welsh College of Advanced Technology, Cardiff. 6.45 p.m.

FRIDAY, 30 SEPT.

A.S.E.E. (Nottingham). Branch annual dinner. Trent Bridge Hotel.

A.S.E.E. (Reading). Branch dinner. Calcot Lounge Hotel.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish Section). "Control Equipment for Ship Stabilisers," J. Bell. Building Centre, Sauchiehall St, Glasgow. 7.15 p.m.

Hewittic Rectifiers FOR STEELWORKS

The illustration shows two 900 kW Hewittic Rectifiers providing an output of 3600 amps for operating rolling mill auxiliaries in a Scottish steelworks.
There are over 1,500,000 kW of Hewittic Rectifiers in world wide service in capacities up to 30,000 kW.

HACKBRIDGE AND HEWITTIC
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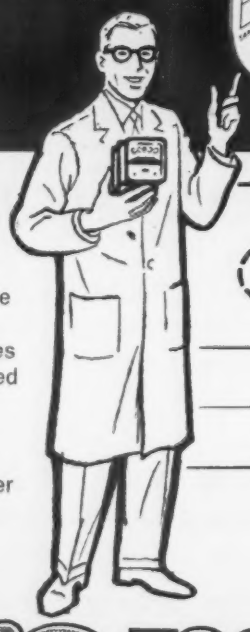
Ahead... right to the finish...

The external finish of the Sangamo Model S200 Meter is taken care of by Bakelite mouldings—proved by more than 25 years of complete satisfaction. The internal finishes reflect the tremendous care in the choice of materials and finishes which has made the S200 the most advanced Watthour Meter of the day. Quantity production in the world's most modern meter factory leads in turn to production economies which are passed on to the user in the form of finer materials, finer specification . . . in short, a better meter for the money.



"SUPERB FINISH IN EVERY ASPECT..."

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sangamo

MODEL S200-7 SINGLE PHASE WATTHOUR METER

SANGAMO WESTON

Years ahead of its time!

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SW/76

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BOROUGH OF EALING

Street Lighting—North Circular Road, St. Anne's Gardens to Uxbridge Road

Tender A

Supply of 88—140 watt sodium lanterns complete with gear and lamps.

Tender B

Supply and erection of 85—25 ft mounting height steel columns.

Details obtainable from Borough Engineer, Town Hall, Ealing, W.5, on payment of £5 for each tender. Returnable on receipt of bona fide tenders.

Tenders to Town Clerk, Town Hall, Ealing, W.5, by noon, 25 Oct., 1960.

E. J. COPE-BROWN,
Town Clerk.
(S 65)

CITY AND COUNTY OF BRISTOL

Main Foul Water Drainage Scheme

SEWAGE DISPOSAL WORKS GENERATING PLANT

MANUFACTURERS suitably experienced in the supply of:

Dual fuel engine alternator sets having approx. output ratings of 750 BHP/525 kW at 3,300 volts, 3 phase, 50 cycles, to operate on sludge gas and diesel oil; together with associated waste heat recovery plant, switchboards, switchgear, transformers and cables.

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SOUTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for engineering vacancies in the Engineers' Department at Surrey Sub-Area Headquarters, Dorking.

THIRD ASSISTANT ENGINEERS (TWO) (CONSTRUCTION)

THIRD ASSISTANT ENGINEER (OPERATION AND MAINTENANCE)

THIRD ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

Salary: £1,190/£1,325 per annum under N.J.B. conditions, Class L, Grade 10. Superannuable.

Applicants, who must possess adequate electrical engineering qualifications or have attained Graduate Membership of the I.E.E., should have a wide experience of both underground and overhead distribution up to and including 33 kV, but may express a preference for one of the above posts.

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Consideration will be given to private car allowance and assistance for house purchase in appropriate circumstances.

Applications, quoting ET and naming two referees, on forms from the Surrey Engineer, Seeboard, Rough Rew, Ridgeway Rd, Dorking, Surrey, by 5 Oct., 1960.

ASSISTANT DISTRICT ENGINEER
MEDWAY DISTRICT

Salary: £825/£940 per annum under N.J.B. Class G, Grade 11. The post, which is superannuable, is in a district with a considerable amount of varied industry, in addition to domestic and commercial loads. Candidates should preferably hold the Higher National Certificate or equivalent, and practical experience in the operation, maintenance and construction of 11 kV and medium voltage underground and overhead systems. Knowledge of the preparation of extension and reinforcement schemes will be an advantage. Applications, quoting ET and naming two referees, to District Manager, Seeboard, Gardiner St, Gillingham, Kent, by 5 Oct., 1960.

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Salary £890/£1,015 per annum under N.J.B. Class E, Grade 8, Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 33 kV. Applications, quoting ET and naming two referees, to District Manager, Seeboard, 80-81 High St, Lewes, Sussex, by 5 Oct., 1960.

GEORGE WRAY,
Secretary.
(S 129)

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APPLICATIONS are invited for the above position. Initially the successful candidate will be located at Battersea, S.W.11.

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Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £685 per annum rising to £855 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/3043/T. (S 123)

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CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

FOURTH ASSISTANT ENGINEER
COVENTRY SECTION
Vacancy No. 224/60.

APPLICATIONS are invited for the position of Fourth Assistant Engineer at Coventry Transmission Section, Victoria Mills, Bulkington, nr. Nuneaton.

Applicants should have experience of maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be in according with Class BX, Grade 11 (£855/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 Oct., 1960.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Section Engineer, Coventry Transmission Section, Victoria Mills, Bulkington, nr. Nuneaton, and should be returned to the Transmission Section by the date stated.

O. S. WOODS,
Divisional Controller.
16 Sept., 1960. (S 117)

EASTERN ELECTRICITY BOARD

Essex Sub-Area

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254/60N.

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Salary: N.J.C. Grade 1 (£640/£740), including London Allowance.

Excellent holiday, sick pay and superannuation schemes.

Apply by letter to: W. E. Wardrop, A.I.E.E., Commercial Officer, Essex Sub-Area, Eastern Electricity Board, 81-85 High St, Brentwood, Essex, by 7 Oct., 1960 (S 146)

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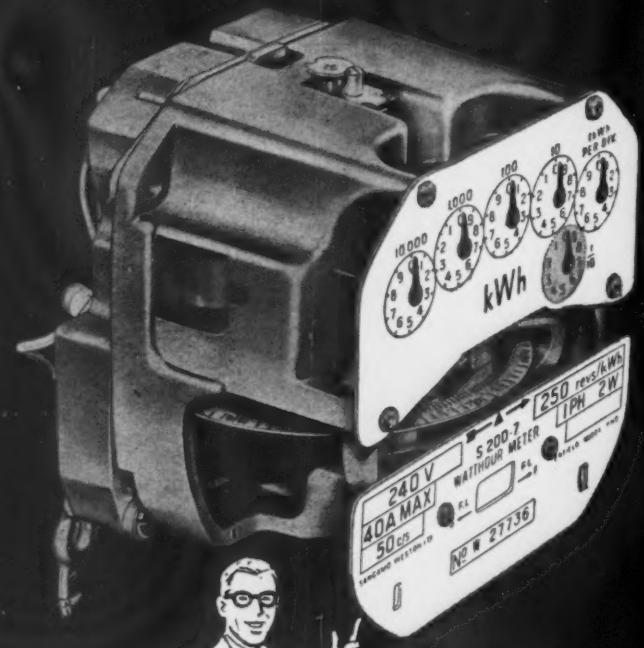

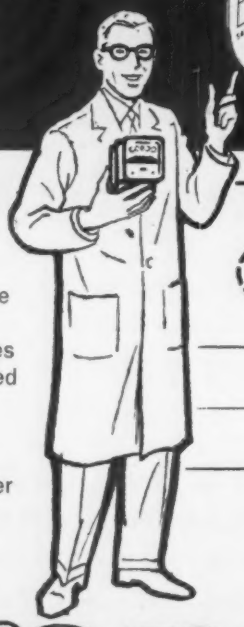

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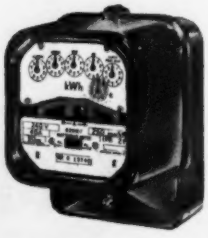

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COUNTY BOROUGH OF WEST BROMWICH

Public Works Department

APPOINTMENT OF ELECTRICAL TECHNICAL ASSISTANT

APPLICATIONS are invited for the above appointment at a salary in accordance with Grade A.P.T. II (£765/£880). The commencing salary will be fixed in accordance with qualifications and experience.

Candidates should be suitably qualified and experienced in the preparation of small schemes and specifications for electrical installation work, together with administration in routine maintenance.

This appointment provides scope and would suit a young ambitious engineer who is capable of controlling and developing a recently formed Electrical Section within the Public Works Department.

Applications stating age, qualifications, present salary, position and experience, giving the names of two persons to whom reference may be made, should be delivered to the undersigned not later than 24 Sept., 1960.

W. H. GREENWOOD,
Borough Engineer and Surveyor.

Town Hall,
West Bromwich. (S 87)

THE GOVERNMENT OF NORTHERN NIGERIA

REQUIRES THREE EXECUTIVE ENGINEERS (ELECTRICAL) on favourable contract terms.

Qualifications:

A University Degree or Diploma exempting from Parts I, II and III of the Institution of Electrical Engineers' examination, or to have passed Parts I, II and III of the Institution of Electrical Engineers' examination or be otherwise experienced in all. In addition any of the following will be an advantage:

(i) Several years' experience in the design, specification of contracts associated with the electrical installation in public buildings and water pumping stations.

(ii) Experience in one or more of the following:

Medium voltage distribution.
Street lighting.
Air-conditioning plant.
Refrigeration.
Diesel engines.
Automobile electrical equipment.
Supervisor control of S.R.H.

Duties:

The preparation of design, specification and estimates, together with the supervision and maintenance of:

(a) Electrical installations in public buildings, S.R.H. quarters, hospitals, schools, water pumping stations, etc.

(b) Diesel engine driven generating plant up to 300 kVA.

(c) Medium voltage, overhead line and underground cable distribution.

(d) The supervision and training of subordinate staff.

Emoluments:

1. SALARY. According to qualifications and experience in the range of £1,104/£2,202.

2. OUTFIT ALLOWANCE of £45 and camp equipment allowance of £40 on first appointment.

3. RESETTLEMENT GRANT of £37 10s for each three months' service inclusive of earned leave payable on satisfactory completion of contract.

4. CHILDREN'S ALLOWANCE. £120 for one child, £216 for two and £288 for three children eligible.

5. FIRST-CLASS PASSAGES for officer and wife on appointment and on leave, and assistance towards cost of children's passages.

Leave:

Generous home leave on full pay.

Applicants should write to: The Recruitment Secretary (Overseas), Northern Region Recruiting Agency, Nigeria Hse, 9 Northumberland Ave, London W.C.2, or telephone TRAfalgar 1244, extension 145. (S 76)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

VACANCY No. 188/60T.

CROYDON DISTRICT
(ELECTRICAL DEPARTMENT)
THIRD ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)

REQUIRED to act as an Assistant to the Operation and Maintenance Engineer. Candidates should have qualifications which will lead to Corporate Membership of the I.E.E., and be familiar with the operation and maintenance of all transmission high voltage equipment including overhead lines.

Salary: Class AX, Grade 8, £1,155/£1,375 per annum, including London Allowance.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy no., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 1 Oct., 1960.

W. H. DUNKLEY,
Divisional Controller.
(S 114)

THE NORTH WESTERN ELECTRICITY BOARD

PRINCIPAL ASSISTANT (COMMERCIAL)
SUB-AREA COMMERCIAL DEPARTMENT
MANCHESTER

DUTIES include assisting in the general organisation of sales activities in the Sub-Area, particularly relating to domestic and commercial consumers. Applicants should have had a wide experience in the organisation and supervision of service centres; planning sales campaigns; preparation of staff training lectures; interior and window displays and exhibition layouts; preparation and giving of lecture demonstrations to outside organisations; and dealing with all types of correspondence from domestic and commercial consumers. Technical knowledge of appliances and installations will be an advantage.

Salary Scale: £1,250 x £35—£1,355 p.a. Grade 7. N.J.C. Conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester 2, P.O. Box 493, and returned to him by 3 Oct., 1960.

Previous applicants need not reapply.

FOURTH ASSISTANT ENGINEER
SUB-AREA ENGINEERING DEPARTMENT
BLACKBURN

Applicants should be experienced in the planning and construction of low, medium and high voltage overhead and underground systems. Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scale: £965/£1,090 p.a. Grade L.13. N.J.B. Conditions.

Application forms to be obtained from the Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, and returned to him by 3 Oct., 1960. (S 96)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (SHIFT RELIEF)
WEST HAM POWER STATION
Vacancy No. 60/785.

Sound technical training with some experience of power station operation. Duties include relief for other N.J.B. shift staff, mainly in Control Room. Salary: Class H, Grade 12, £1,015/£1,140, plus £96 10s/£109 shift per annum.

Applications, quoting Vacancy No. to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London W.1, by 3 Oct., 1960. (S 95)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

GENERAL ASSISTANT DISTRICT
COMMERCIAL ENGINEER
LOTHIANS DISTRICT

SALARY: N.J.B. SCHEDULE A. CLASS G. GRADE 11. £825/£940 p.a. (REVISED SALARY SCALE).

APPLICATIONS are invited for the appointment of a General Assistant District Commercial Engineer in the Lothians District, based on Musselburgh, and should be submitted not later than 7 Oct., 1960.

Duties will include the installation and operation of street lighting maintenance, liaison with Local Authority Street Lighting Engineers and the maintenance of records. Applicants should have a knowledge of good street lighting practice and be able to carry out photometric tests. Possession of an O.N.C. or equivalent technical qualifications will be an advantage.

Conditions of service are in accordance with the National Joint Board Agreement for the Electricity Supply Industry and the successful candidate, subject to satisfactory evidence of health, will require to become a contributor to the Board's Superannuation Scheme.

The successful candidate will require to reside within a reasonable distance of the District Office at Musselburgh.

C. H. A. COLLYNS,
Manager.

52 Melville St,
Edinburgh 3. (S 88)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER

REQUIRED at Hams Hall "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.12. £965/£1,090 per annum, plus 10% shift allowance.

Applicants should have received a sound technical training and should preferably have had experience in the control of the works supply system. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 247/60MD on Forms AE6, which are available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warwickshire, to whom they should be returned when completed not later than 3 Oct., 1960. (S 94)

THE NORTH EASTERN ELECTRICITY BOARD

ASSISTANT CHIEF COMMERCIAL OFFICER

APPLICATIONS are invited for the appointment of Assistant Chief Commercial Officer at Area Board Headquarters.

The successful applicant will be responsible for the development of supplies to commercial, domestic and farming consumers, including specialised utilisation by these classes of consumers. He will also have control of publicity and will be required to assist in sales staff training. Another important aspect of the appointment is a functional interest in service centres, testing of appliances and public lighting.

Applicants should have a wide experience in the commercial organisation of the electricity supply industry and preferably be corporate members of the Institution of Electrical Engineers.

Conditions of service according to National Joint Managerial and Higher Executive Grades Committee Agreement for the Electricity Supply Industry. Salary scale: Class B, Grade 8, £2,595/£2,815 per annum, according to qualifications and experience. There is a compulsory contributory superannuation scheme.

Applications, marked "Confidential," should be submitted to the Secretary, The North Eastern Electricity Board, Carliol Hse, Newcastle upon Tyne 1, not later than 10 Oct., 1960. (S 106)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

THE NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of Second Assistant District Engineer, Crook District.

Applicants must have had sound practical training and experience in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and auxiliary equipment. Preference will be given to candidates with qualifications leading to corporate membership of I.E.E.

Salary: Schedule A, Class E, Grade 7, £965/£1,090. N.J.B. conditions of employment.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (S 107)

BOROUGH OF HORNSEY

SENIOR ENGINEERING ASSISTANT (ELECTRICAL/MECHANICAL)

GRADE APT. IV/V (£1,110/£1,420) INCLUDING LONDON WEIGHTING £45

APPLICATIONS are invited for the above appointment from applicants with appropriate qualifications. Commencing salary according to experience.

The succesful candidate will be responsible for electrical maintenance and renewal, specification for and supervision of new work by contract or direct labour for all Council undertakings. Experience in heating/ventilation would be an advantage.

Applications on forms to be obtained from the Borough Engineer and Surveyor, Town Hall, N.8. to be returned not later than Monday, 10 Oct., 1960.

The appointment is superannuable and subject to Conditions of Service of the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services.

W. B. MURGATROYD,
Town Clerk.
(S 110)

CITY OF SALISBURY

Southern Rhodesia

VACANCY FOR ELECTRICAL ENGINEER
SALARY: £1,025/£1,768 2s 6d

APPLICATIONS are invited for the post of Electrical Engineer in the Salisbury Municipal Electricity Department, on the above scale.

Commencing salary is based on qualifications and experience, with a barrier at £1,563 2s 6d per annum, above which no engineer can rise without being a corporate member of the British Institution of Electrical Engineers, and £1,614 7s 6d per annum is the maximum entry point into the grade.

Candidates must be graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree.

Experience in the design and planning of distribution networks and substations from L.T. 11 kV and up to and including 33 kV, the preparation of technical specifications and the compiling of investigatory reports on general distribution problems, together with general experience on mains and substation construction works on a large undertaking is essential.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital status should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs Davis and Soper Ltd., 52-54 St. Mary Axe, London E.C.3, to whom applications must be submitted on or before 15 Oct., 1960. (S 86)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a FOURTH ASSISTANT ENGINEER (PROTECTION) in the Technical Section of the Chief Engineer's Department at Board Head Office.

Applicants should possess a degree or Higher National Certificate in Electrical Engineering and should preferably have had some experience in commissioning high voltage electrical apparatus and in the routine maintenance and testing of protective gear. Previous experience at the works of a manufacturer of the above equipment would also be an advantage. The scope of the work embraces equipment in the Board's generating stations and transmission system.

Salary, according to qualifications and experience. N.J.B. Schedule B, Class BX, Grades 9 (£1,005/£1,325), 10 (£935/£1,245), or 11 (£855/£1,165).

Applications, quoting reference E33/60, should be submitted on the standard form, available from the Secretary, South of Scotland Electricity Board, Inverlair Ave, Cathcart, Glasgow S.4, not later than 7 Oct., 1960. (S 109)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

NORTHFLEET POWER STATION
VACANCY No. 186/60T.
ASSISTANT ENGINEER

APPLICATIONS are invited for the appointment of an Assistant Engineer for general duties. These will include the organisation and training of the fire fighting, first-aid and civil defence teams, advising on matters of safety, supervision of security and cleanliness of the power station.

Salary: N.J.B. M13, £1,090/£1,215 per annum, including London Allowance.

Applications, giving age, details of qualifications, experience, etc., should be sent to the Station Superintendent, Northfleet Power Station, Crete Hall Rd, Northfleet, Kent, to arrive by 30 Sept., 1960.

W. H. DUNKLEY,
Divisional Controller.
(S 113)

THE EAST MIDLANDS ELECTRICITY BOARD

Derby and Burton Sub-Area:

VACANCY No. 104/60.
ASSISTANT WAYLEAVE OFFICER

SALARY: N.J.C. Grade 2, £700 x £25—£775 per annum.

The duties will include assisting in the negotiation of wayleaves for overhead lines and underground cables, substation sites, etc., and the settlement of compensation claims for damage to crops, etc.

Candidates should preferably have some knowledge of overhead line construction and should possess a current driving licence.

Applications giving details of age, present position and salary, qualifications and experience should be addressed to The Manager, Derby and Burton Sub-Area, Electricity Offices, Irongate, Derby, in a confidential envelope endorsed "Assistant Wayleave Officer" within 14 days of the date of this advertisement.

Area Board Headquarters

VACANCY No. 105/60.
SENIOR ASSISTANT (PERSONNEL)

Salary: N.J.C. Grade 5 (£1,020 x £30—£1,140 per annum) or Grade 6 (£1,150 x £30—£1,240 per annum) according to qualifications and experience.

The duties will be mainly concerned with education and training, but will also include other aspects of the work of the Personnel Section.

Applicants should have some experience in industrial training and possess a University degree or a recognised professional qualification.

Applications giving details of age, qualifications, previous experience, present position and salary, should be addressed to the Secretary, The East Midlands Electricity Board, Mapperley Hall, Lucknow Ave, Nottingham, in an envelope endorsed "Senior Assistant (Personnel)," within 14 days of the date of this advertisement. (S 108)

UNIVERSITY OF QUEENSLAND

SENIOR LECTURER IN ELECTRICAL ENGINEERING

APPLICATIONS are invited for the above-mentioned position. Applicants must hold an Honours Degree and preferably a higher degree in Electrical Engineering with specialisation in electronics.

The duties will include lectures in advanced circuit and field theory and arrangement of the appropriate practical work.

The salary for a Senior Lecturer is £A2,520 to £A2,870 p.a.

Further particulars and information as to the method of application should be obtained from the Secretary, Association of Universities of the British Commonwealth, 36 Gordon Sq, London W.C.1.

Applications close, in Australia and London, on 15 Oct., 1960. (S 75)

BRISTOL COLLEGE OF SCIENCE AND TECHNOLOGY

(A College of Advanced Technology)

Ashley Down, Bristol, 7

Principal:
G. H. Moore, M.SC., F.P.S., F.R.I.C.

THE Governors invite applications for the posts of LECTURERS (2) to teach heavy current subjects in courses leading to Dip.Tech.I.E.E. Part III, Higher National Diploma and Higher National Certificate. Candidates must hold appropriate academic and/or professional qualification and should have had teaching, industrial and/or research experience.

Salary within the range £1,370/£1,550.

Application forms, returnable within two weeks, and details from the Registrar. (S 98)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

SENIOR COMMERCIAL ASSISTANT

APPLICATIONS are invited for a Senior Commercial Assistant at Dingwall. The main duties will be those of a Consumers' Adviser, and candidates should possess wide experience in commercial matters, particularly relating to Local and Public Authorities, and with special consumer problems on tariff, connection terms and condition of supply. A broad knowledge of the Electricity Supply Industry is essential. Salary commencing at a point within the range £1,150 x £30—£1,240 (N.J.C. Grade 6), depending on experience and qualifications. Superannuation Scheme. Applications should be made by 30 Sept. on form to be obtained from Area Manager, Church St, Dingwall, Ross-shire. (S 90)

THE SOUTH WALES ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (WORKSHOPS)

APPLICATIONS are invited for the position of Third Assistant Engineer (Workshops) in the Area Engineer's Department, Monmouthshire and Mid-Wales Area at Cwmbran.

Preference will be given to engineers possessing Higher National Certificates in Electrical and Mechanical Engineering.

The successful applicant may be able to obtain housing accommodation in the Cwmbran New Town after a reasonable waiting period.

Salary: N.J.B. Class K, Grade 9, Scale 10 (£1,190/£1,325 per annum).

Applications stating age, present position, present salary, qualifications and experience, should be addressed to D. G. Gwyn, B.SC., A.M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Rd, Cwmbran, Mon, to arrive not later than 1 Oct., 1960. Please quote reference 171/60/ET, endorsing envelopes "Third Assistant Engineer (Workshops)."

R. G. WILLIAMS,
Secretary.
(S 89)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

FIRST ASSISTANT STATION CHEMIST
NORTHAMPTON POWER STATION
Vacancy No. 221/60.

APPLICATIONS are invited for the position of First Assistant Station Chemist at Northampton Power Station, Houghton Rd, Northampton.

Previous experience in a power station laboratory is essential and candidates should, at least, hold the H.N.C. in Chemistry. Candidates must be familiar with methods of sampling and analysis of coal, oil and water and with the interpretation and application of analytical results.

Salary will be in accordance with Class G, Grade 9 (£965/£1,090 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Oct., 1960.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)
CASTLE DONINGTON POWER STATION
Vacancy No. 226/60.

Applications are invited for the position of Assistant Maintenance Engineer (Electrical) at Castle Donington Power Station, near Derby.

Applicants should have received a thorough technical and practical training with experience in maintenance of alternators, transformers, switchgears and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class L, Grade 8 (£1,350/£1,500 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 Oct., 1960.

GENERAL ASSISTANT ENGINEER
WILLINGTON POWER STATION
Vacancy No. 222/60.

Applications are invited for the position of General Assistant Engineer at Willington Power Station, P.O. Box No. 27, Derby.

Candidates should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend on qualifications and knowledge and will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 7 Oct., 1960.

GENERAL ASSISTANT ENGINEER
(CHEMIST)
(MALE OR FEMALE)
WILLINGTON POWER STATION
Vacancy No. 223/60.

Applications are invited for the position of General Assistant Engineer at Willington Power Station, P.O. Box No. 27, Derby.

Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be within the range £625/£805 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 7 Oct., 1960.

STATION SHIFT CONTROL ENGINEER
DERBY POWER STATION
Vacancy No. 218/60.

Applications are invited for the position of Station Shift Control Engineer at Derby Power Station, Full St, Derby.

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class F, Grade 10 (£825/£940 per annum) of the

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National Joint Board Agreement plus £90 per annum shift enhancement.

Closing date for receipt of applications: 7 Oct., 1960.

FIRST ASSISTANT STATION CHEMIST
SPONDON POWER STATION
Vacancy No. 213/60.

Applications are invited for the position of First Assistant Station Chemist at Spondon Power Station, Spondon, nr. Derby.

Previous experience in a power station laboratory is essential and candidates should preferably be Associates of the Royal Institute of Chemistry or hold an equivalent qualification. Candidates must be familiar with the methods of sampling and analysis of coal, oil and water and with the interpretation and application of the analytical results. Experience with the problems arising from high-pressure, high-temperature operation and of the solution of such problems is desirable.

Salary will be in accordance with Class J, Grade 8 (£1,190/£1,325 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 30 Sept., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.
(S 118)

YORKSHIRE ELECTRICITY BOARD

No. 1. (Bradford) Sub-Area

PRINCIPAL ASSISTANT (ADMINISTRATION)

THE successful candidate will be required to assist in the supervision of all sections of the Secretarial Department and will be responsible for the department in the absence of the Sub-Area Secretary.

Salary: N.J.C. Grade 9, £1,530/ x £40—£1,650 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, Yorkshire Electricity Board, No. 1 (Bradford) Sub-Area, 45-53 Sunbridge Rd, Bradford 1, not later than 7 Oct., 1960.

No. 7 (Grimsby) Sub-Area

SCUNTHORPE DISTRICT
SECOND ASSISTANT DISTRICT ENGINEER

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They should have had a sound training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. underground and overhead distribution systems, substation plants and ancillary equipment in both urban and rural areas.

Salary: N.J.B. Class G, Grade 7 (Scale 9), £1,115/£1,245.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, Yorkshire Electricity Board, No. 7 (Grimsby) Sub-Area, Moss Rd, Grimsby, not later than 7 Oct., 1960.

No. 2 (Huddersfield) Sub-Area

FOURTH ASSISTANT COMMERCIAL ENGINEER
(HEATING DEVELOPMENT)

The successful applicant will be required to assist in the development of load—particularly electrical methods of off-peak space heating—in commercial and industrial premises. The appointment is especially suitable for a recently trained engineer who wishes to extend his experience in the utilisation of electricity for heating purposes.

Salary: N.J.B. Class L, Grade 13 (Scale 7), £965/£1,090 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, Yorkshire Electricity Board, No. 2 (Huddersfield) Sub-Area, Market St, Huddersfield, not later than 7 Oct., 1960.

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No. 6 (Hull) Sub-Area

GOOLE DISTRICT
ENGINEERING DRAUGHTSMAN

Applicants should have had a good general education and be fully conversant with all aspects of work in a Cartographic and Recording Drawing Office. The successful applicant will be required to supervise the Cartographic and Recording Section of the District Drawing Office and previous experience in a supervisory capacity will be an advantage.

Salary: N.J.B. Scale 3, £715/£805 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, Yorkshire Electricity Board, No. 6 (Hull) Sub-Area, Ferensway, Kingston upon Hull, not later than 7 Oct., 1960.

No. 4 (Leeds) Sub-Area

SENIOR SALES REPRESENTATIVE
(COMMERCIAL CATERING)

Applicants should have had previous sales experience, preferably within the Electricity Supply Industry and be competent to give advice in connection with the planning and installation of electrical equipment used by the commercial catering and baking trades.

Preference will be given to applicants who have served an electrical apprenticeship or who are in possession of the Sales Certificate or Diploma of the Electrical Development Association.

Salary: N.J.C. Grade 2, £700 x £25—£775.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, Yorkshire Electricity Board, No. 4 (Leeds) Sub-Area, Bramhope, Leeds, not later than 7 Oct., 1960. (S 126)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position at Wimbledon, S.W.19.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work.

Pending determination as to the grading of the post within Schedule A of the National Joint Board Agreement, the salary will be in the provisional range £755 per annum rising to £855 per annum inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/3097/T. (S 124)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER

REQUIRED in the Warrington District of the Board's No. 2 Sub-Area. Salary within range £1,535/£1,720 per annum (N.J.B. H/3).

Duties will include the organisation and control of all commercial activities in the Warrington District in accordance with the Board's Commercial policy.

Applicants should have wide experience on the Commercial side of an Electricity Supply Undertaking, and should possess appropriate technical qualifications.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 3 Oct., 1960. (S 121)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Ironbridge Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J.9, £1,115/£1,245 per annum, plus 10% for shift duties.

A sound technical training and practical power station experience are required in the operation of steam generating plant and main switchgear. Appropriate technical qualifications an advantage.

Apply quoting Vacancy No. 256/60MD on forms AE6 which are available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to be completed and returned not later than 3 Oct., 1960. (S 122)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEERS
(MAINTENANCE AND OPERATION)
TWO VACANCIES

READING and Oxford Districts of No. 2 (Newbury) Sub-Area. Salary, in each case, N.J.B. Class J, Grade 9 (£1,115/£1,245 per annum). N.J.B. Conditions of Service.

The duties of the posts will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1252, and indicating which vacancy, not later than 3 Oct., 1960.

ASSISTANT ENGINEER (LOCAL)

Staines District of No. 1 (Southall) Sub-Area, located at Sunninghill. Salary N.J.B. Class G, Grade 9 (£965/£1,090 per annum). N.J.B. Conditions of Service.

Applicants should have had experience in operation and maintenance work on overhead and underground distribution systems up to and including 11 kV.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1227, not later than 3 Oct., 1960.

ASSISTANT ENGINEERS
(MAINTENANCE AND OPERATION)
TWO VACANCIES

Swindon and Newbury Districts of No. 2 (Newbury) Sub-Area.

Salaries: Swindon District, N.J.B. Class G, Grade 9, £965/£1,090 per annum. Newbury District, N.J.B. Class F, Grade 9, £890/£1,015 per annum. N.J.B. Conditions of Service.

The duties of the posts will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1253, and indicating which vacancy, not later than 3 Oct., 1960.

ASSISTANT ENGINEER (PLANNING)

Salisbury District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£765/£870 per annum). N.J.B. Conditions of Service.

The successful candidate will be required to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in Electricity Supply Distribution and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1233, not later than 3 Oct., 1960.

SENIOR SHOWROOM ATTENDANT

Staines District of No. 1 (Southall) Sub-Area. Salary N.J.C. Grade 2 (£700/£775 per

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annum, plus London Weighting). N.J.C. Conditions of Service.

Applicants should have experience in all showroom duties and a sound knowledge of domestic apparatus, sales procedure, application of tariffs and consumer service.

Applicatons on forms obtainable from the Sub-Area Secretary, 2/6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1254, not later than 3 Oct., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (S 125)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:—

SECOND ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
BRISTOL GROUP

Salary according to Class L, Grade 8, Salary Scale 12—£1,350/£1,500 per annum—of the N.J.B. Agreement.

The person appointed will be required to undertake the planning and preparation of schemes, estimates and reports for immediate and long-term extension and reinforcement of underground and overhead distribution systems up to and including 33 kV. This work will include preparation of specifications for plant and equipment, load flow and system fault-level calculations, estimates of load growth and future reinforcement trends, and technical and economic assessment of District capital sanctions.

Considerable experience of planning, construction and operation of distribution systems up to 33 kV, underground and overhead, together with a sound knowledge of all types of plant and equipment is essential.

Qualifications leading to membership of the Institution of Electrical Engineers are desirable.

Applications to be made on standard form AE6/ACT obtainable by Postcard only from the Group Administrative Officer, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is Saturday, 8 Oct., 1960. (S 130)

EASTERN ELECTRICITY BOARD

Essex Sub-Area

NORTH ESSEX DISTRICT
FITTER (ELECTRICAL)
256/60.R.

APPLICATIONS are invited for the position of Fitter (Electrical) in the North Essex District. Rates of pay and conditions of service in accordance with the Agreement of the National Joint Industrial Council for the Electricity Supply Industry. Present rate of pay 5s 6¼d per hour.

Apply by letter to J. C. Horrell, M.I.E.E., Manager, North Essex District, Eastern Electricity Board, Cressing Rd, Braintree, Essex, by 7 Oct., 1960.

Northmet Sub-Area

JOINTER (EXTRA HIGH TENSION)
255/60.R.

Jointer (E.H.T.) required by the Eastern Electricity Board, Construction Department, New Southgate, for work on the Board's Mains in the Northmet Sub-Area.

Rate of pay: 5s 10¼d per hour for a 42-hour, five-day week.

The conditions of service will be in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry.

Apply by letter to the Construction Engineer, Northmet Sub-Area, Eastern Electricity Board, 15 Friern Barnet Rd, New Southgate, London N.11, by 30 Sept., 1960. (S 128)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER

REQUIRED in the Northwich District of the Board's No. 2 Sub-Area. Salary within range £890/£1,015 per annum (N.J.B. F/9).

Applicants should have received an engineering training, and have had experience in H.V. and M.V. overhead and underground distribution work. Technical qualifications desirable.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 3 Oct., 1960. (S 120)

THE SOUTH WALES ELECTRICITY BOARD

HEAD OFFICE
PRINCIPAL ACCOUNTANCY ASSISTANT

APPLICATIONS are invited for the post of Principal Accountancy Assistant in the Chief Accountant's Department at St. Mellons. Preference will be given to applicants with a recognised accountancy qualification, and with experience in the preparation of final accounts, management financial statistics and long-term capital and revenue estimates.

The salary will be in accordance with a national salary scale (£1,530/£1,650) and the post is superannuable.

Applications, giving details of age, education, qualifications, experience, present position and salary, should be forwarded to the undersigned at St. Mellons, Cardiff, to reach him not later than Wednesday, 5 Oct., 1960.

Envelopes should be endorsed "Principal Accountancy Assistant."

R. G. WILLIAMS,
Secretary.
(S 132)

MINISTRY OF HEALTH

ENGINEER (TECHNICAL WORKS)

PENSIONABLE post in London for man at least 30 on 1 Sept., 1960, for duties concerned with pricing and cost analysis of mechanical and electrical engineering services in buildings. Qualifications: apprenticeship and good experience in mechanical/electrical installation and maintenance work; technical qualifications of H.N.C. standard normally expected. Applicants must be familiar with contract conditions. Salary scale: £1,375/£1,589. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S/5199/60. Closing date: 20 Oct., 1960. (S 111)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

Vacancy No. ET/127/60.
GENERAL ASSISTANT ENGINEER

REQUIRED at Portishead "B" Power Station.

Superannuation Scheme. Salary: N.J.B. Class K, Grade 15, Scale 4, £765/£870 per annum.

Preference will be given to candidates who hold or are at present studying for a Higher National Certificate or similar qualification.

Previous applicants need not re-apply.

Applications on form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 5 Oct., 1960. (S 119)

THE SOUTH WALES ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER
(MAINS)

APPLICATIONS are invited for the position of General Assistant Engineer (Mains) in the Newport District of the Monmouthshire and Mid-Wales Area of the Board.

Preference will be given to Engineers possessing a Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class G, Grade 9, Scale 7 (£965/£1,090 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to D. G. Gwyn, B.SC., A.M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Rd, Cwmbran, Mon, to arrive not later than 8 Oct., 1960. Please quote reference 174/60/ET, endorsing envelopes "General Assistant Engineer (Mains)."

R. G. WILLIAMS,
Secretary.
(S 131)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Northmet Sub-Area

SUB-AREA HEADQUARTERS, LONDON N.14

APPOINTMENT OF SUB-AREA ACCOUNTANT
(RE-ADVERTISEMENT)
251/60.R.

Applications are invited from qualified Accountants in the Electricity Supply Industry for the appointment of Accountant for the Northmet Sub-Area.

Candidates should possess a wide experience of punched-card accounting methods including the use of electronic calculators and other up-to-date equipment, as a major programme of mechanisation is in progress. Applicants must also show that they have the ability to direct and supervise a large accounting staff.

The salary, which has just been revised by the appropriate negotiating machinery, is £2,875/£3,100 per annum, including London Allowance, in accordance with N.J.M. Grade 5, Class F.

Apply by letter giving full details of age, qualifications, experience, present salary and position, to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet Hse, Southgate, London N.14, by 30 Sept., 1960.

Applications forwarded in response to the original advertisement in August will be considered and need not be resubmitted.

ST. ALBANS DISTRICT

(a) TWO THIRD ASSISTANT ENGINEERS
(Ref. 975 and 987)

(b) FOURTH ASSISTANT ENGINEER
(Ref. 963)
252/60.R.

Candidates for the above positions should have had sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class G (a) Grade 9 (£965/£1,090); (b) Grade 11 (£825/£940).

Apply by letter to F. J. Drake, ASSOCIATE I.E.E., Manager, Eastern Electricity Board, 107 St. Peter's St, St. Albans, by 3 Oct., 1960.

Chilterns Sub-Area

LUTON DISTRICT

THIRD ASSISTANT ENGINEER
253/60.R.

continued in next column

continued from previous column

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary: N.J.B. Class J, Grade 9 (£1,115/£1,245).

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487 Dunstable Rd, Luton, by 7 Oct., 1960. (S 127)

A LEADING Transformer Oil Company requires the services of a suitably QUALIFIED ELECTRICAL ENGINEER for marketing Transformer Oil over the United Kingdom. Based in the North Eastern area. I.E.E. member preferred. Salary according to age and experience. Reply Box No. 7999, Electrical Times. (S 45)

ASSISTANT ELECTRICAL ENGINEER

in Consulting Engineer's London office. Design supervision of electrical installations in schools, hospitals, factories, etc. Five-day week. Superannuation. Salary range £800/£1,000 p.a.

Apply in writing:

R. W. GREGORY AND PARTNERS,
21 Bloomsbury Way, W.C.1.
(S 103)

BRITISH Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. ELECTRICAL SURVEYOR required in Scotland. Permanent position carrying progressive salary scale £800/£1,100 and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply, stating age, qualifications and experience. (S 141)

ELECTRICAL ENGINEER

A qualified Engineer is required by Company engaged in the design, manufacture and erection of low temperature process plants. Applicants must be capable of designing a complete electrical system and layout, including cable selection, routeing and control wiring, etc., for an Air Separation Plant, of supervising drawing preparation and writing complete installation specifications. He should be conversant with the specification of high tension switchgear and large machines, etc., and have practical field experience.

Please apply to:

Personnel Manager,
AIR PRODUCTS (G.B.) LTD.
49-50 Poland St,
London W.1.
(S 91)

BP requires an ELECTRICAL ENGINEER for service with its Exploration Department in the Persian Gulf. Applicants aged between 25 and 30 must possess H.N.C. and preferably be Graduate Members of the I.E.E. Applicants should have experience in the installation and subsequent maintenance of Electrical Equipment, associated with Gas Turbine Generating Plant of 2,000 kW installed capacity; diesel engine driven generating plant; 3·3 kV and 440 V Overhead and Underground distribution systems; domestic, industrial and flameproof equipment. Salaries according to qualifications and experience. Short leave to the U.K. every four months. Generous kit and other allowances. Free medical attention. Write giving full particulars, quoting F.592, to Box 3301, c/o. Hanway Hse, Clark's Pl, E.C.2. (S 97)

CABLE JOINTERS required for work up to 11 kV in Cardiff area. Send brief details, age, experience, etc., to Box No. 8011, Electrical Times. (S 145)

'ENGLISH ELECTRIC'
STAFFORD

offer appointments in

TENDERING AND CONTRACTS ENGINEERING
for
HEAVY ELECTRICAL PLANT

Applications are invited from electrical engineers to deal with customer liaison involving the compilation of tenders and estimates and the co-ordination of contracts for the following types of heavy electrical equipment:

HEAVY SWITCHGEAR
POWER TRANSFORMERS
POWER RECTIFIERS
ROTATING MACHINES

This work provides an opportunity to gain valuable experience of up-to-date heavy electrical techniques and applications as well as offering a secure and promising career in a stable industry.

Applicants should possess an H.N.C.(E) or higher qualifications. Engineers who are in the last year of the course will, however, be considered.

HOUSING—tenancy of an unfurnished house or flat can be considered where an applicant is otherwise unable to settle in the district.

Membership of the Staff Pension and Life Assurance Scheme and eligibility for three weeks' holiday follow a qualifying period of service.

If you would like to visit Stafford to discuss these vacancies please write, giving full details, to G.P.S., English Electric Hse, Strand, London W.C.2, quoting reference ET/1297N.
(S 31)

contact

FULLER ELECTRIC

A member of the Hawker Siddeley Group

ELECTRICAL ENGINEERS

Thanks to our long association with ASEA, Sweden, we have access to unrivalled experience in extra high voltage developments. Interesting and progressive positions exist in our Engineering Departments for young Electrical Engineers to widen their experience and knowledge of high voltage power equipment.

Applicants should preferably have completed an apprenticeship and obtained a degree or H.N.C.

Salaries up to £1,250 per annum will be paid to successful applicants, commensurate with their experience, ability and qualifications.

Application Forms obtainable from:

Personnel Manager

FULLER ELECTRIC LIMITED

FULBOURNE ROAD LONDON E.17

Telephone: LAR 2350

(S 34)

DESIGN ENGINEER required for Consulting Engineer's Office to undertake the design of electrical services for all classes, of buildings, including hospitals, industrial and commercial buildings, at home and abroad. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to: J. Roger Preston and Partners, 15 North Audley St, London W.1. (S 100)

ELECTRICAL CONTRACTORS require SITE AGENT/FOREMAN with experience in H.T. and L.T. cabling, copper busbar erection, etc. Please write giving full details to Box No. 8005, Electrical Times. (S 83)

ELECTRICAL ENGINEER required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (S 140)

ELECTRICIAN required, Lambeth baths and laundry; 5s 3¼d per hr. (5s 6½d per hr. from 1 Nov., next) 44-hr. week; shift work; enhanced rates paid. Applications in writing to Superintendent, Lambeth Baths, China Walk, S.E.11. (Quote Ref. E b). Closing date 30 Sept., 1960. (S 102)

BRITISH RAILWAYS

RAILWAY ELECTRIFIED LINES

OVERHEAD MAINTENANCE STAFF

Vacancies exist on the Eastern Region Electrified Lines in the London area. Applicants selected will be engaged as ASSISTANT OVERHEAD TRACTION LINEMEN at a base rate of 198s per week. The average earnings for this grade amount to approximately 260s per week. Shift working is involved. Courses of instruction are given and good opportunities exist for promotion to higher grades. Apply giving full particulars of age, experience, etc., to Electric Traction Engineer (London Area), British Railways, Eastern Region, off Ley St, Ilford, Essex, or apply in person to the Supervisor, Overhead Line Depot, Jutsums La, Romford, Essex. Details of Conditions of Service, rail travel facilities, Pension and Sick Pay Schemes will be supplied at the interview. (S 25)

REACTOR FOREMEN

AND

POWER PLANT FOREMEN

are required by the

UNITED KINGDOM ATOMIC ENERGY AUTHORITY AT WINDSCALE AND CALDER WORKS CUMBERLAND

Reactor Foremen will take complete control of a Nuclear Reactor, associated plant and staff, and be responsible, on shift, for its safe and efficient operation. Successful applicants will be given adequate training to fit them for these duties.

Power Plant Foremen will be responsible, on shift, for the safe and efficient operation of turbo-alternators and associated plant, and the E.H.V. and H.V. switchgear and distribution system.

Applicants must have served a recognised engineering apprenticeship and should have had experience in the operation of steam plant and/or heavy mechanical and/or electrical plant. Possession of an O.N.C. or equivalent may be an advantage.

Salary within the scale £925 (at age 30)—£1,105 p.a. Additional payments are made for regular shift work.

Contributory Superannuation. Staff Housing Scheme.

Send postcard for application form, quoting reference P/W.53/J8, to: Recruitment Officer, U.K.A.E.A., Production Group, Windscale Works, Sellafield, Seascale, Cumberland.

(S 93)

ASSISTANT ELECTRICAL ENGINEER

A vacancy exists in our London Office for a man aged 25-30 having H.N.C. (Electrical) for interesting and varied work on the design, specification and installation of industrial electrical equipment and distribution systems including specialised drives and controls and instrumentation for production plant.

Applicants should have some practical background and several years' experience of design work. Salary will be according to qualifications and experience, details of which should be sent in writing to:

P. G. HUTCHINGS,
Personnel Officer,
MINNESOTA MINING & MFG. CO., LTD.
3M House, Wigmore St, W.1.

(S 92)

ELECTRICAL DRAUGHTSMAN able to apply himself to a wide variety of work. A knowledge of power switchboard construction would be an advantage.—Astral Switchgear Ltd., Alma Rd, Ponders End, Middlesex. (S 99)

SWITCHGEAR DESIGNERS
for
ELLISON SWITCHGEAR

If you have design experience with the gear mentioned below, there may be a permanent position for you on our design staff. We require:

ONE SENIOR HIGH TENSION OIL CIRCUIT-BREAKER DESIGNER (UP TO 11 kV)

and

ONE SENIOR LOW TENSION OIL/AIR BREAK DESIGNER

These appointments offer many advantages, including a non-contributory pension scheme and the usual sports and social facilities. Write to our

Personnel Manager
at
George Ellison Ltd.,
Perry Barr, Birmingham 22B.

(S 134)

ELECTRICAL DRAUGHTSMAN required for Consulting Engineer's Office to assist in the preparation and design of electrical services for all classes of buildings, including hospitals, industrial and commercial buildings, at home and abroad. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to: J. Roger Preston and Partners, 15 North Audley St, London W.1. (S 101)

ELECTRICAL SUPERVISING or ESTIMATING ENGINEER used to industrial contracts, required for Cardiff Branch of Drake and Gorham (Contractors) Ltd. Write giving details of experience, etc., to 13 St. Andrew's Cres, Cardiff. (S 116)

LIGHTING ENGINEERS, senior and junior, required by London company for the preparation of specialised fluorescent lighting schemes. The positions are permanent and pensionable with excellent salaries for the right men. The senior applicant must be prepared to handle inquiries from initial contact to completion. Applications giving full details to Box No. 8009, Electrical Times. (S 144)

POLYPHASE ELECTRICITY METER TESTERS. Also young men with electrical experience as trainees. Modern factory conditions. Please inquire: Personnel Manager, Landis and Gyr Ltd., Victoria Rd, North Acton, W.3. (Acorn 2282.) (S 115)

Monsanto

SENIOR ELECTRICAL DRAUGHTSMAN

required in the Engineering Department, London. Experience of power, lighting and control installation in the chemical or allied industries is essential. Applicants, preferably with H.N.C. and practical background in electrical engineering, should be able to work on own initiative.

Good salary and prospects in permanent post; non-contributory pension scheme.

Applications, giving details of age, qualifications and experience, should be sent to:

The Staff Relations Officer, (DL 170)
MONSANTO CHEMICALS LIMITED,
Monsanto House,
10/18 Victoria Street,
LONDON, S.W.1.

(S 112)

DRAUGHTSMEN
for
ELLISON SWITCHGEAR

We have vacancies in our modern drawing office for staff who have sufficient experience to fill the following positions.

SENIOR LOW TENSION OIL CIRCUIT-BREAKER SWITCHBOARD CONTRACTS DRAUGHTSMAN

SENIOR LOW TENSION AIR CIRCUIT-BREAKER SWITCHBOARD CONTRACTS DRAUGHTSMAN

THREE JUNIOR DRAUGHTSMEN

Advantages include: non-contributory pension scheme, good canteen and the usual sports, social and welfare facilities. Apply:

Personnel Manager,
George Ellison Ltd.,
Perry Barr, Birmingham 22B.

(S 135)

AGENCIES

FOR DOMESTIC ELECTRIC APPLIANCES, men having good connections with retailers, Departmental Stores (not London). State other lines carried and territory regularly covered. Reply in writing. —Sales Director, Metway, Brighton. (S 137)

PATENTS

THE Proprietors of Patent No. 713174 for "IMPROVEMENT IN OR RELATING TO FLAME-RESISTANT INSULATED CONDUCTORS" desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to HASELTINE LAKE AND CO., 28 Southampton Bldgs, Chancery La, London W.C.2. (S 142)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (S 1)

DIESEL GENERATING PLANTS WANTED!!! Price and particulars to Speed Electrics, Church St, Basford, Nottingham. Tel. 75716. (S 105)

APPOINTMENTS WANTED

YOUNG MAN, O.N.C. (ELECT.), continuing studies, experienced control gear, D.O. test, etc., seeks interesting post with scope for experience and advancement. Lab. D.O. sales, etc., considered. Salary: £850. London Area.—Box No. 8007, Electrical Times. (S 139)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co. Ltd., Stanmore, Middx. (S 2)

EXCAVATION, CABLE LAYING, JOINTING, etc. Estimates free, prompt attention. All work guaranteed 12 months. Anywhere in Lincolnshire, Norfolk, Suffolk, Rutland, Cambridgeshire preferred but not essential.—W. T. Parker Ltd., 113-115 Station St, Burton-on-Trent, Staffs. (S 143)

FOR SALE

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

Sale of Redundant Plant

CLEPINGTON, CITY SQUARE AND LOCHEE SUBSTATIONS, DUNDEE

THE following plant is offered for sale at the above Substations:

Westinghouse Rotary Converter—550 kW, 400/550 V d.c. output, complete with Control Gear and 750 kVA O.N. Transformer, Primary Voltage 6,600.

Westinghouse Rotary Converter—550 kW, 400/550 V d.c. output, complete with Control Gear and 610 kVA O.N. Transformer, Primary Voltage 6,600.

Lancashire Dynamo Company Motor—346 V, 177 A, 1,465 r.p.m. continuous rating, Star/Delta Starter for above.

Three Series Wound d.c. Generators, 25/50 V, 500/700 A, continuous rating. Control Panels for above Generators.

100 kVA 3-phase 50 cycles 6,600/400 V O.N. Transformer, Vector Group 41Dyll.

100 kVA 3-phase 50 cycles 6,300/363 V O.N. Transformer, Vector Group 41Dyll.

150 kVA 3-phase 50 cycles 6,300/440 V O.N. Transformer, Vector Group 41Dyll.

Four 200 kVA 3-phase 50 cycles 6,300/433 V O.N. Transformer, Vector Group 41Dyll.

25 kVA 3-phase 50 cycles 346/346 V O.N. Transformer, Vector Group 41Dyll.

125 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

100 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

70 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

50 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Two 40 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

30 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Two 25 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Five 20 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Two 15 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

10 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Two 5 kVA 3-phase 50 cycles 415/346 V O.N. Auto Transformer.

Details of the above Equipment, Form of Tender, and General Conditions of Contract may be obtained from:

R. B. ANDERSON, M.I.E.E., M.I.Mech.E.
Area Manager
7 DUDHOPE CRESCENT ROAD
DUNDEE

Closing date for offers will be 10 days from the date of this advertisement. The Board are not bound to accept the highest or any offer.

(S 104)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566/9. (S 4)

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (S 9)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 7 Rothschild Rd, W.4. (S 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4. Stores at Chobham, Surrey. (S 7)

FOR SALE.—27½ kVA GENERATING SETS.—B.G. Plant (Sales Agency) Ltd., Watlington 44, Oxon. (S 136)

IF you require d.c. current at 30 kV to 40 kV please note: For Sale Ferranti Oil Cooled TRANSFORMER RECTIFIER, input 400/1/50, output 20 kV to 40 kV at 375 mA, complete with controls and instruments, suitable for electrostatic precipitation, etc. Unused, low price.—L. Solloman Ltd., Beaufort St, Manchester 3. Phone: BLAckfriars 4571. (S 20)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (S 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept., E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (S 8)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.). Purley, Surrey. Uplands 4818/9. (S 6)

SECOND-HAND electrical plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Park, Middx. Telephone: Wembley 3121: Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (S 10)

CLEARANCE OFFER

ELECTRIC LAMPS, OSRAM, MAZDA, ETC.

(Ex M.O.S.) Guaranteed New in Original Packings

	Net price, tax incl. £ s d
General Lighting Lamps, Pearl and Clear:	
200 and 210 V, 15, 25, 40 W, bay. cap .. .. .. p. 100	2 10 0
200 V, 60 W and 100 W, Edison screw cap .. .. p. 100	2 10 0
200 V, 150 W, Edison screw cap .. .. p. 100	4 0 0
200 V, 1,000 W, G.E.S. .. .. each	5 0
220 V and 230 V, 40, 60 W, Edison screw .. .. p. 100	2 10 0
220 V and 230 V, 15, 25, 40 W, blue B.C. .. .. p. 100	2 0 0
230 V, 100 W, Edison screw .. .. p. 100	3 0 0
230 V, 150 W, Edison screw .. .. p. 100	4 0 0
230 V, 750 W and 1,000 W, G.E.S. .. .. .. each	5 0
240 V, 1,500 W, cable end .. .. each	6 0
Low Voltage Lamps: 35 V, 50 V, 60 V, 75 V, 80 V, 100-130 V, 15-500 W: S.B.C., S.E.S., B.C., E.S., G.E.S., on inquiry.	
Mercury Discharge Lamps:	
220-230 V, 80 W, MB/V, B.C.-3-pin .. .. .. each	6 0
220-230 V, 80 W, MBF/V B.C.-3-pin .. .. .. each	6 0
240 V, 125 W, MBF/V, G.E.S. .. .. each	7 6
240 V, 400 W, MAF/V, G.E.S., ISOTHERMAL .. each	15 0
240 V, 500 W, MAT/V, G.E.S. .. .. each	1 5 0
200/250 V, 400 W, NE/H, 5 A, 2-prong x 2 cap OSIRA NEON DISCHARGE TUBE, 45 x 1¼ in.	1 0 0
100 W, AH4 T10 Tubular E.S. (American)	15 0
Chokes: OSIRA, 200-250 V, 80 W, solid filled	15 0
,, OSIRA, 200-250 V, 400 W, solid filled	1 10 0
SODIUM LAMP TRANSFORMERS, 180-220 V, 140 W ..	1 0 0
Fluorescent Tubes: 4 W Miniature (American) 6 in. pinless and 2 min-bipin cap, Daylight, Blue, Blacklight, U.V.	2 6
25 W Tubes, 36 in., white, med-bipin	2 6
Neon Lamps: 0·5 W OSGLIM INDICATOR, 200-220 V and 250/260 V, p. 100	5 0 0
Ditto (without resistance), S.B.C., S.E.S., B.C.	3 0 0
¼ W, 125 V, Can-Screw (American)	7 10 0
2½ W, 125 V, Med. Screw (American)	5 0 0
Special Festoon (Osglim), WB2504, 10 x 45 mm	5 0 0
Linolite Striplight Lamps with 100 W, 230 V lamp, 309 mm, complete .. .. each	15 0
Replacement lamp	3 0
Carbon Filament Lamps: 100-120 V, 5-50cp, S.B.C., B.C.	1 0
220 V, 50cp, Clear and Flame, B.C.	3 0
110 V and 250 V, 250 W, Heaterlamp Tubular, B.C., Flame ..	6 0

Ballast Lamps, Resistance Lamps, Miniature (Torch, Radio Panel) Lamps, Aircraft Lamps, Auto-Lamps, Projection Lamps on inquiry.

SPECIAL: Brass Lampholders, Screw Base (American), with Key Switch, 250 V, 250 W, in Export Packing .. .. p. 100 £2 10 0

SUPLEX LAMPS LTD., 239 HIGH HOLBORN, LONDON, W.C.1

HOL 0225, 4543. Tel: SUPLEXLAMP HOL LONDON

(S 55)

EDUCATIONAL

GUARANTEED COACHING for CITY AND GUILDS EXAMINATIONS—Electrical Engineering Practice; Electrical Installation Work and Illumination Engineering, many practical non-examination courses. No books to buy. Write for FREE Prospectus, stating subject, to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. S 13)

MAINTENANCE ENGINEERS—Read "Electrical Fault" Diagnosis." A quick guide to the detection and correction of electrical machine troubles. Price 15s post free from Book Department, Electrical Times, Sardinia Hse, Sardinia St, London W.C.2.

"SAFEGUARDS Against the Explosion Hazard in Industry," indispensable to Design and Works Engineers. Only 6s post free from Book Department, Electrical Times, Sardinia Hse, Sardinia St, London W.C.2.

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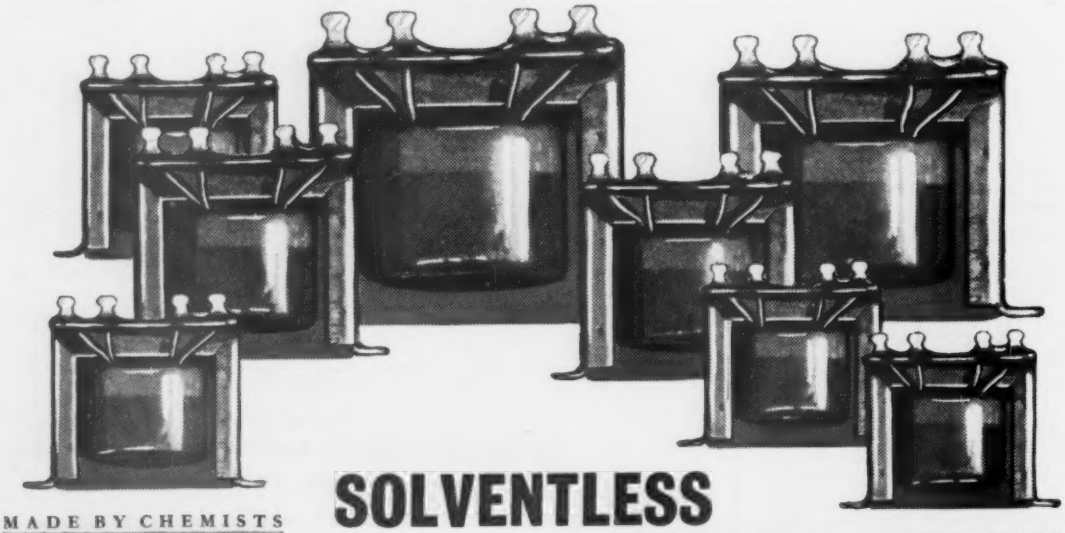

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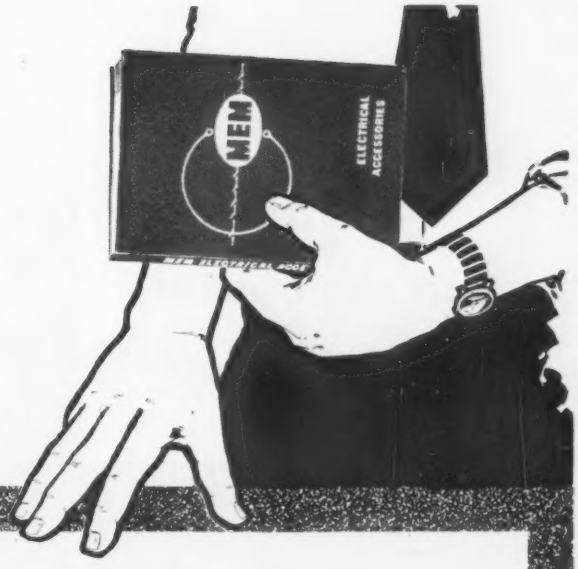

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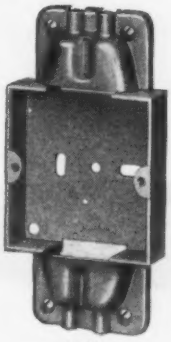
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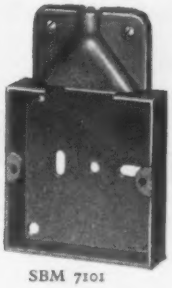
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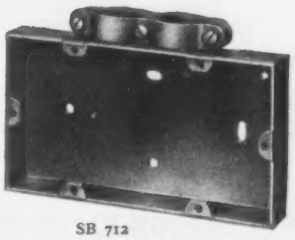
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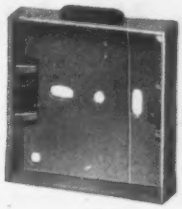
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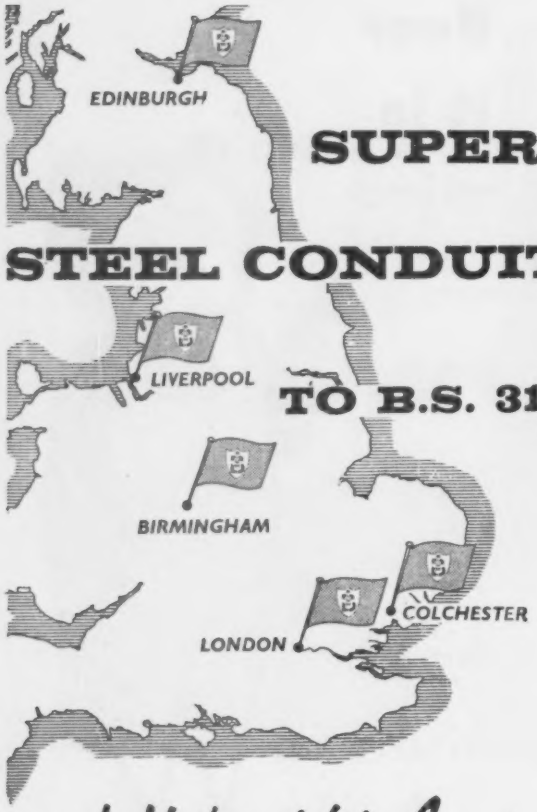

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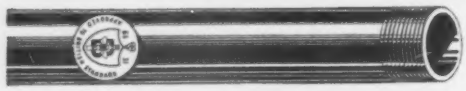

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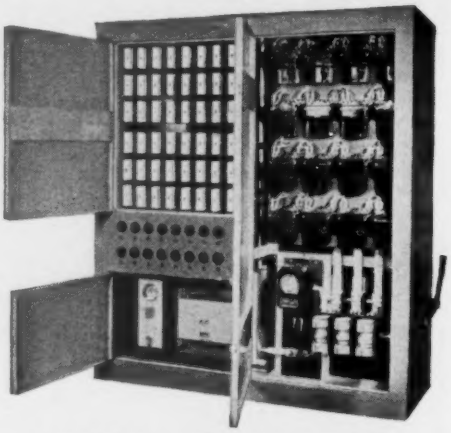

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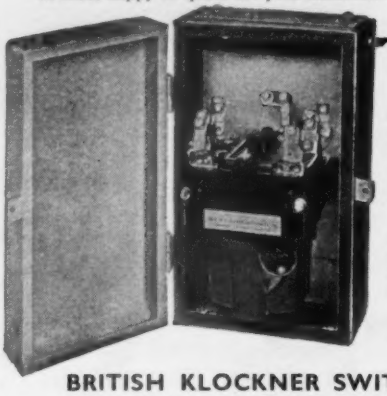

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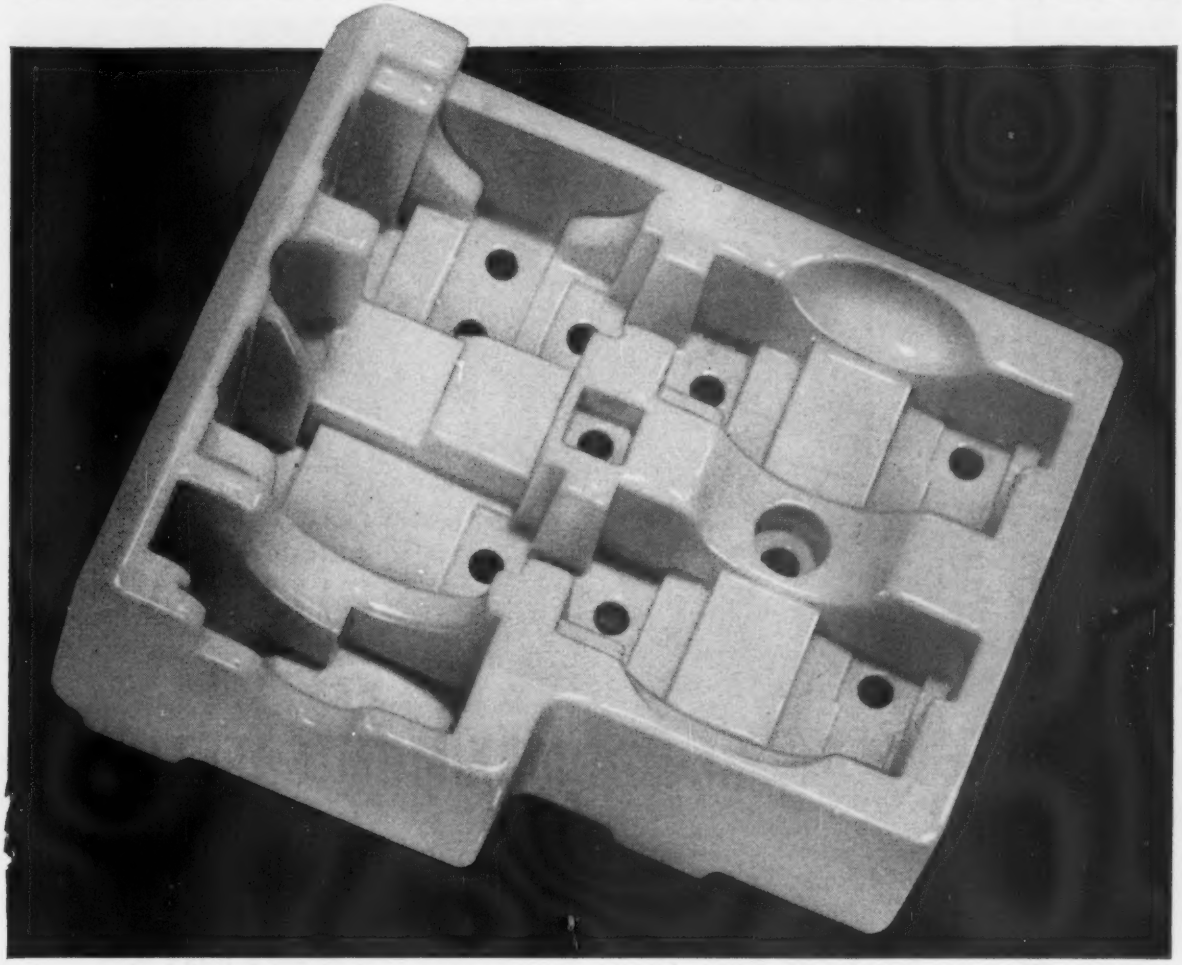

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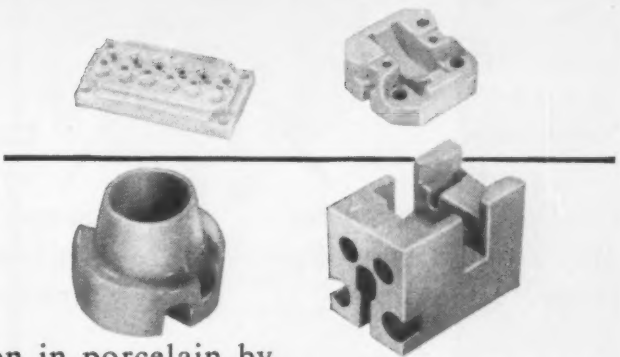

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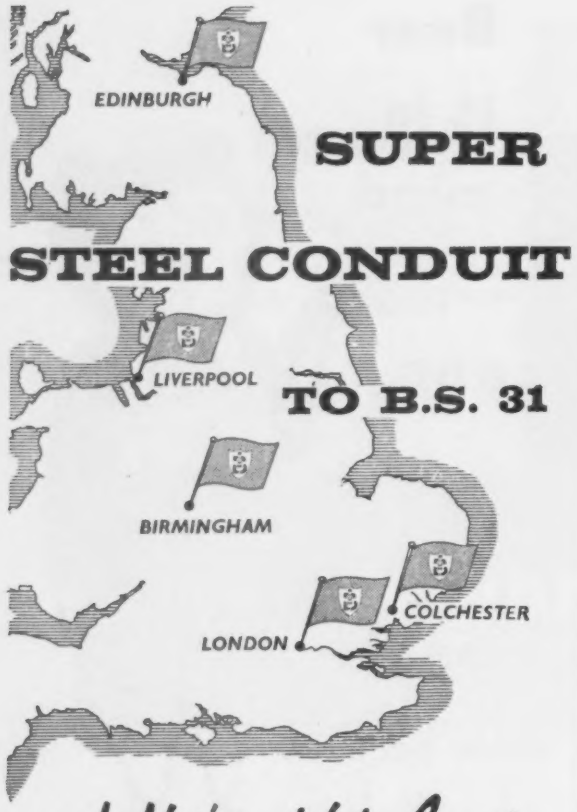

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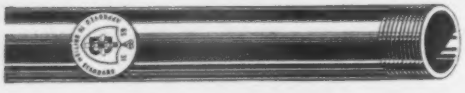

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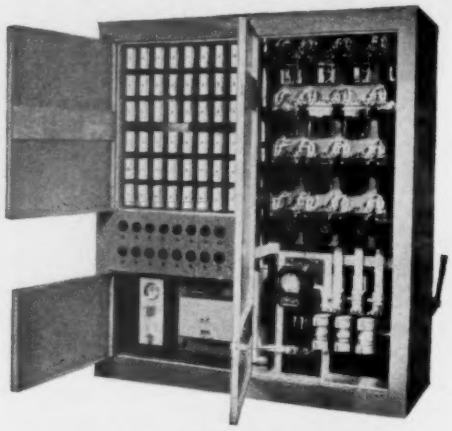

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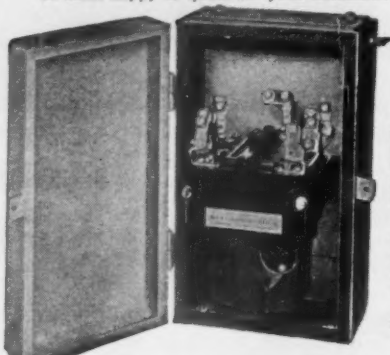

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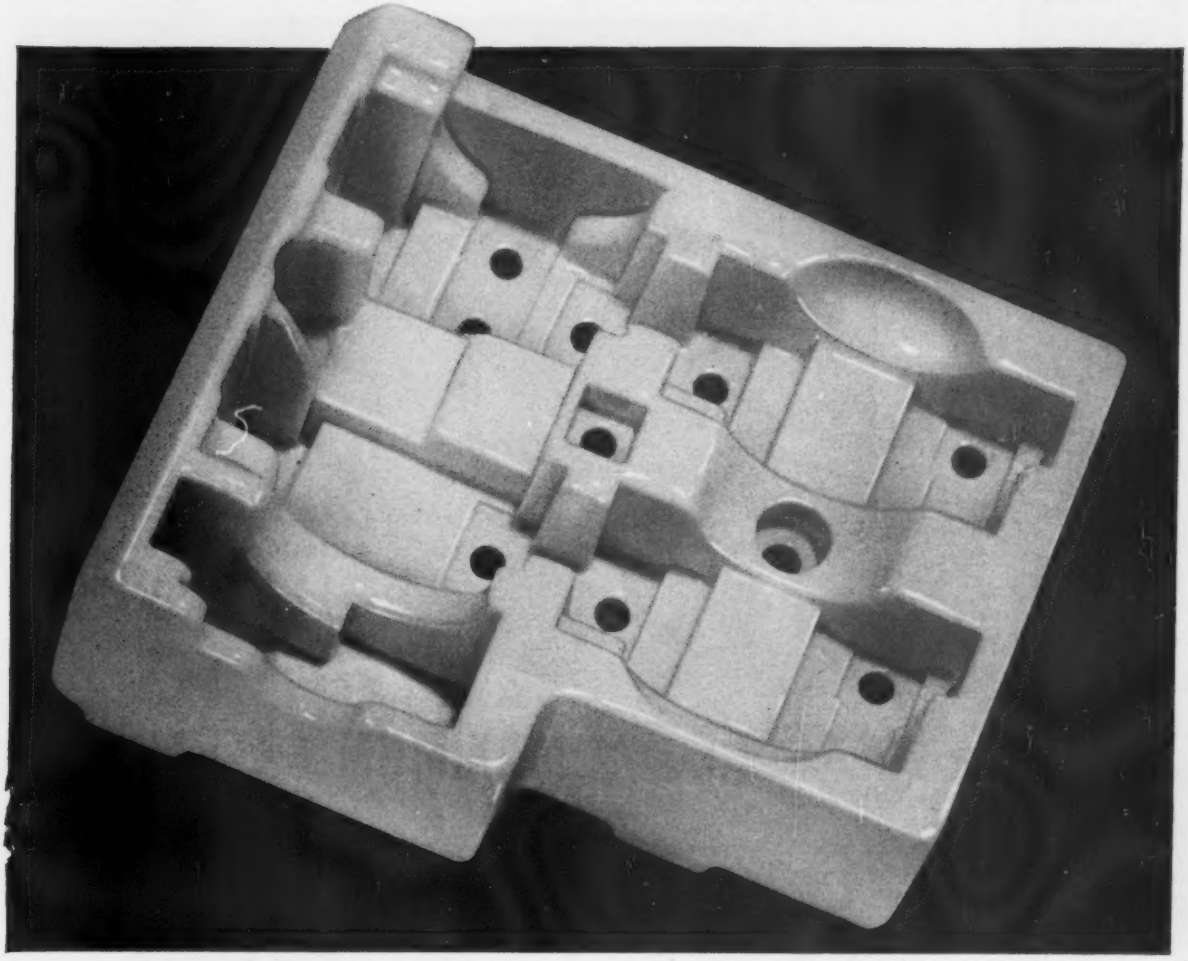

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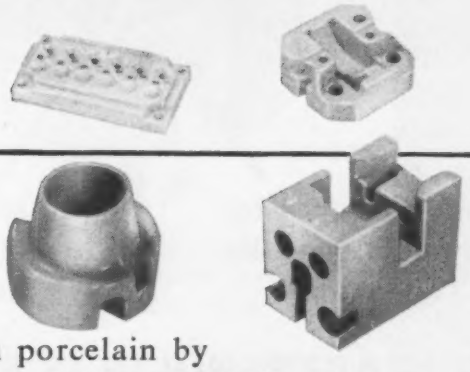

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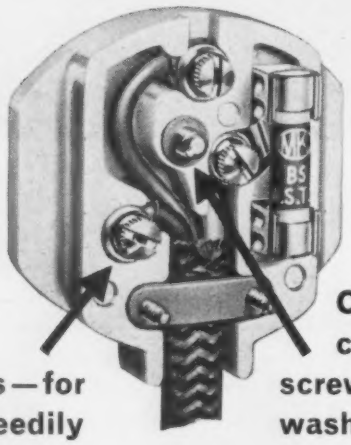

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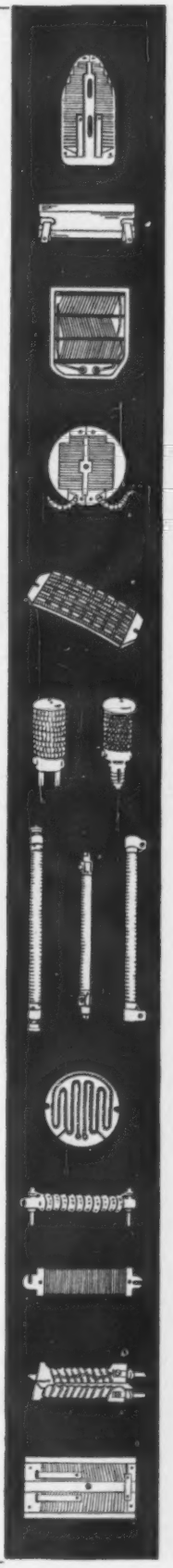

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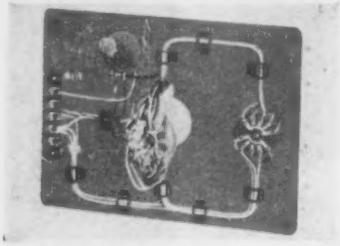

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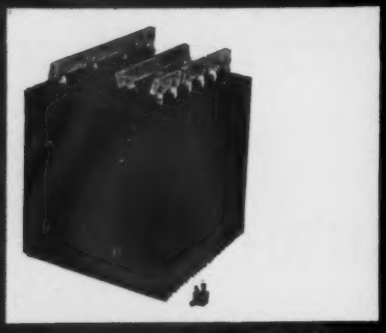

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One of a large number of Motor Starter Switchboards, non-sparking, installed 15 miles off-shore on Oil Gathering Stations in Lake Maracaibo (salt water), Venezuela. These switchboards are completely weatherproof and operate under the most exacting climatic conditions conceivable.

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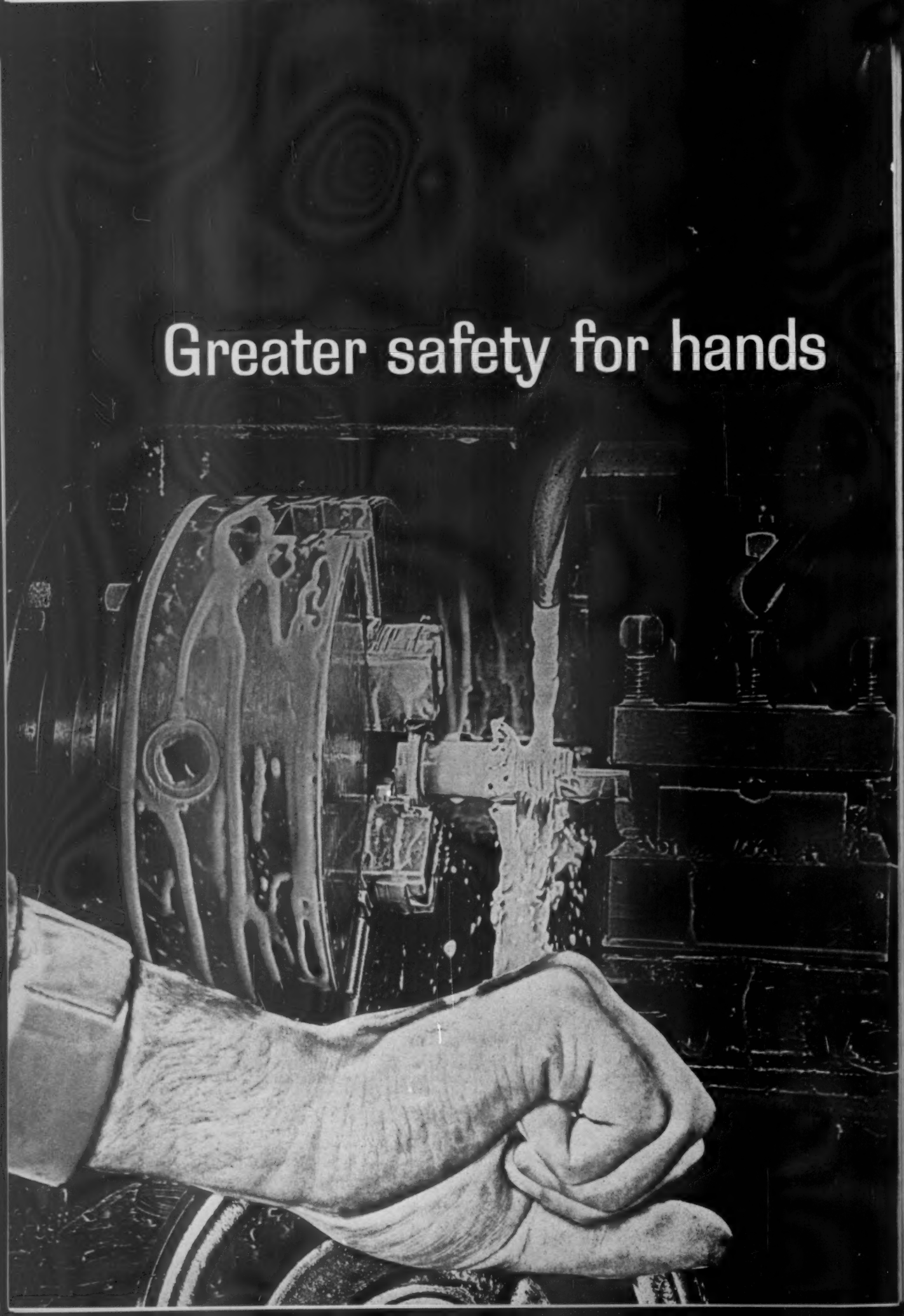


With new Shell Dromus Oils

Most modern soluble cutting oils contain phenolic compounds used as coupling agents between the oil and the emulsifier, for better blending and easier mixing. These phenolic compounds can cause skin irritation, especially where modern high-speed machines are used and the emulsion can concentrate, through the evaporation of water, above the safety level.

Shell research chemists have been working on this problem, which has been causing some concern to Management. After considerable research, Shell Dromus Oils have been reformulated and these new cutting oils now produce bland emulsions, which considerably reduce the risk of skin trouble to operators.

The real difficulty was to find a new coupling agent to replace the phenolic compounds, and Shell finally used what their chemists know as a higher fatty alcohol complex. This solved one problem, but presented another. The new coupling agent was volatile at the high temperatures normally used in blending processes. Further research found a solution to this problem by designing and installing new plant.

The new Dromus Oils are every bit as efficient as before and cost no more. They put Management in the welcome position of being able to minimise working hazards at no extra cost. And machine men need no longer be so worried about skin troubles.

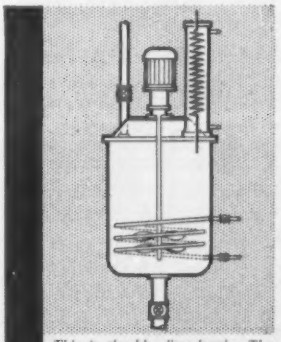
The moral of the story is that Shell research is supremely applicational. The centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organization have any major lubricating problems, it pays to get in touch with your local supplier of Shell Industrial Lubricants.

The Research Story

Shell chemists in the U.K., in Holland and in the U.S.A., prepared and examined hundreds of experimental soluble oils, and established that certain combinations of fatty alcohols could be used in place of phenolic compounds with no loss of efficiency. They set to work to discover the best combination and developed a higher fatty alcohol complex which fitted exactly. Then they realised that to blend this new coupling agent into soluble oils would require special plant and new blending techniques.

Exhaustive testing of blend stability, emulsion stability, anti-corrosion and machining properties led to selection of the most promising blends. A pilot plant was set up to produce batches of these for use in field trials.

This field testing and final development proceeded for two years whilst production plants were erected at points so chosen as to give the most economical and rapid delivery throughout the United Kingdom.



This is the blending kettle. The reflux condenser beside the stirrer motor prevents the loss of constituents volatile at the blending temperature.

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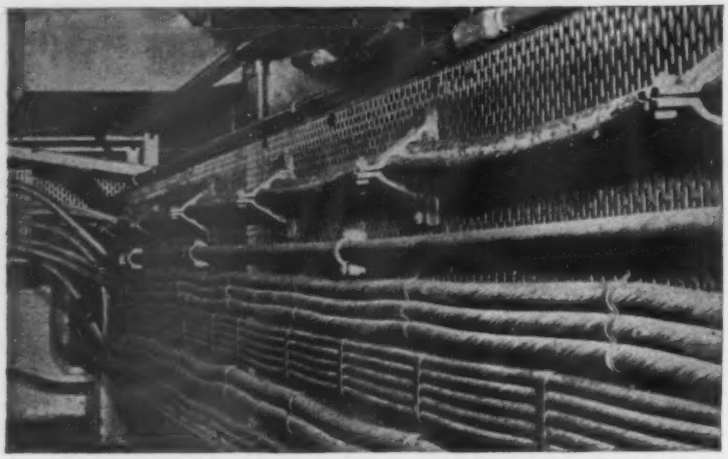

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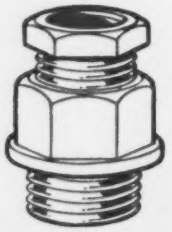

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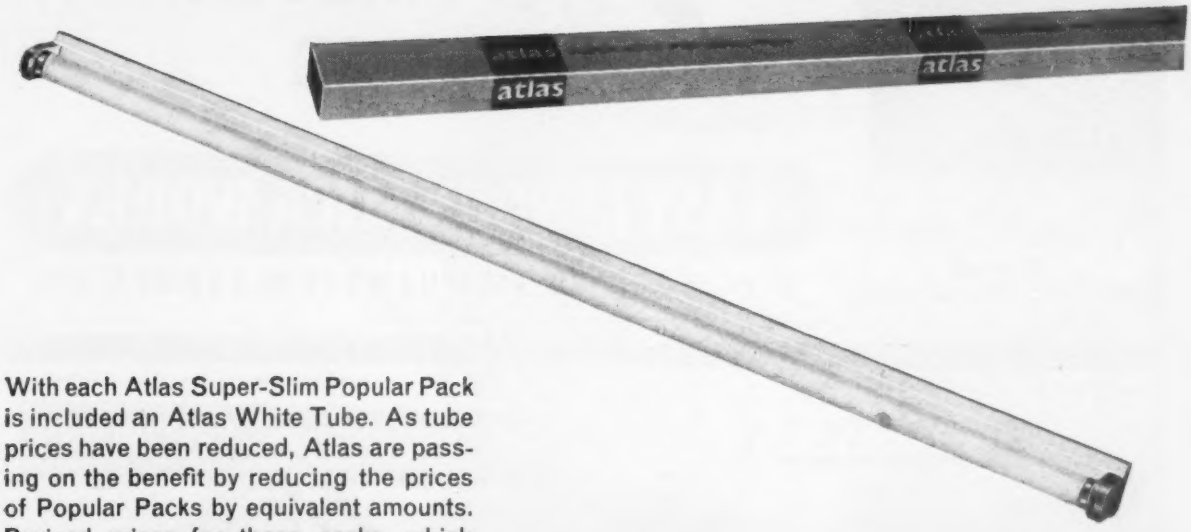

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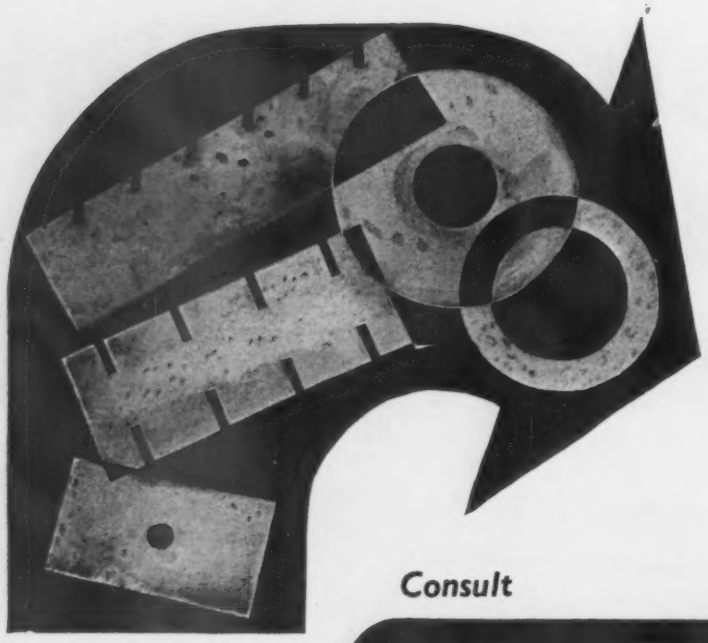

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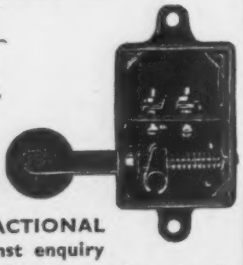

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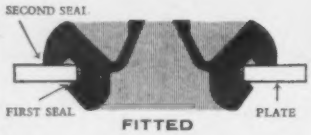

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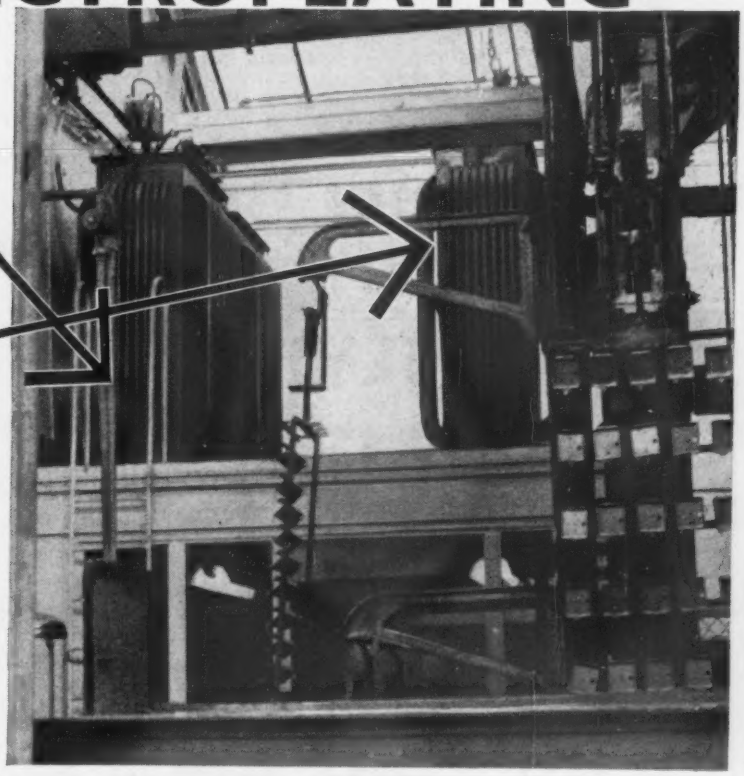

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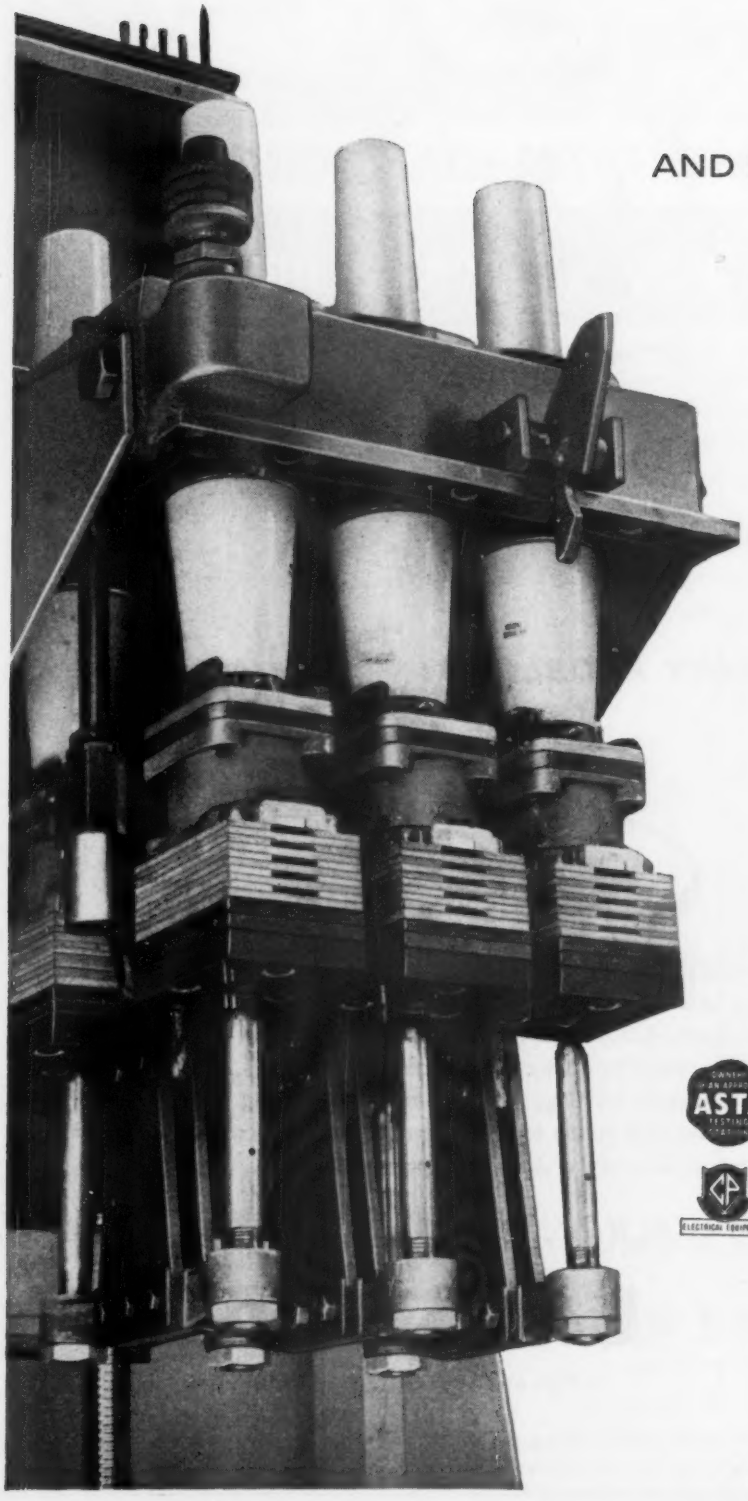

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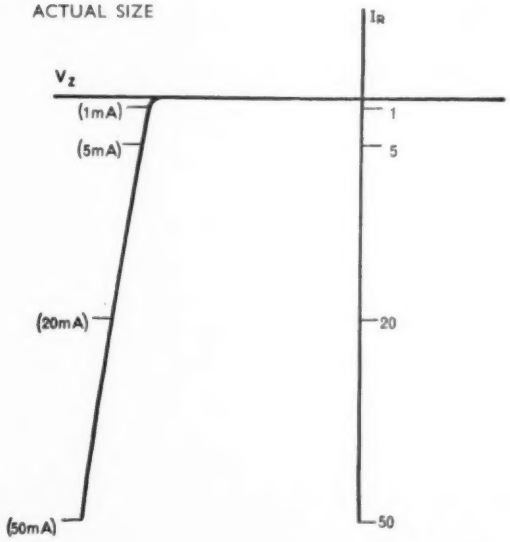

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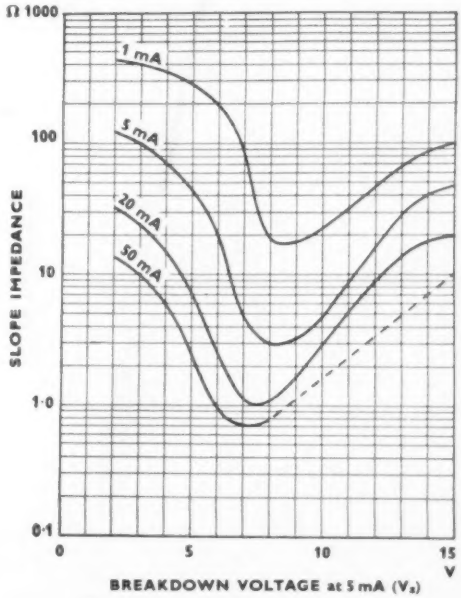

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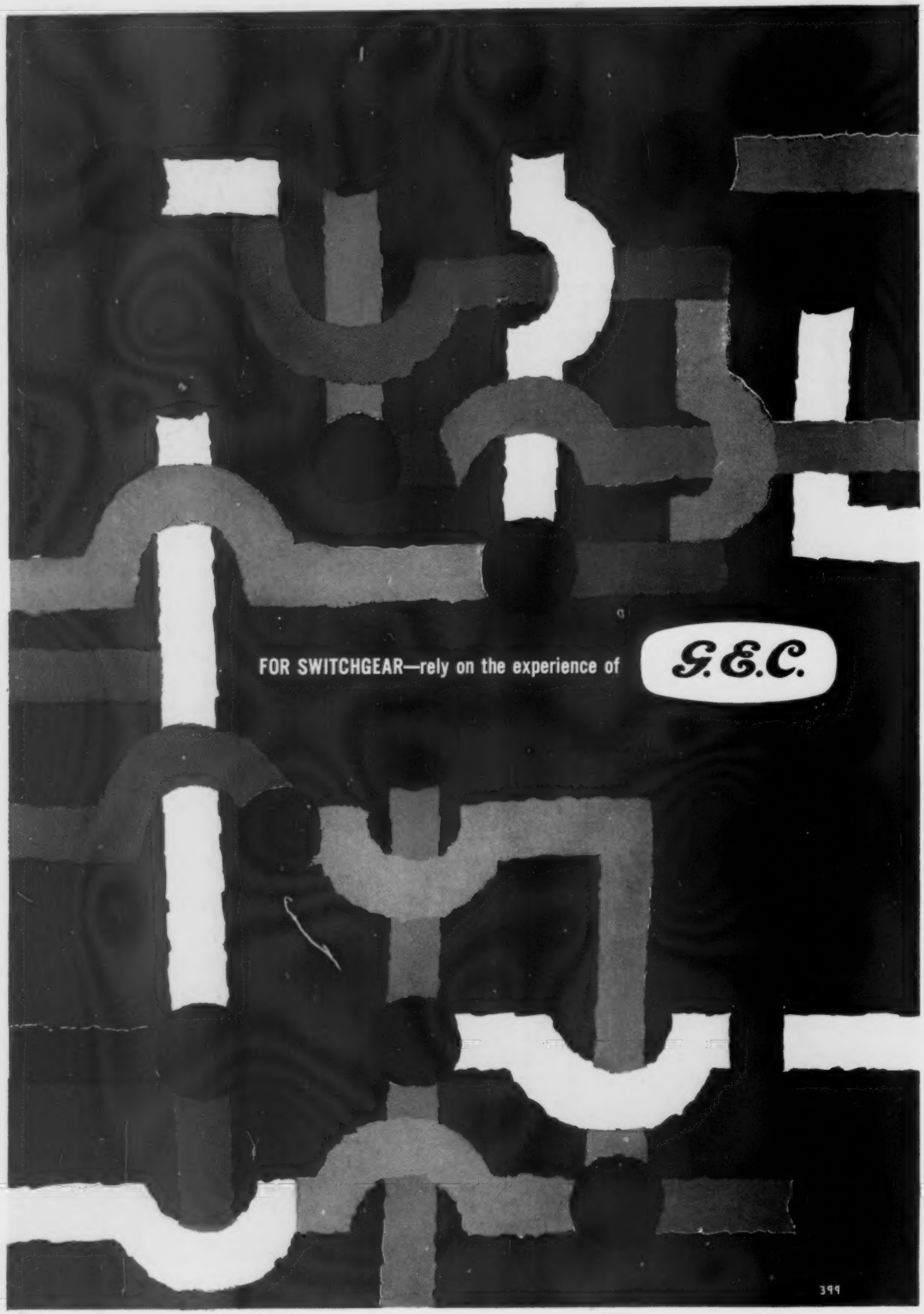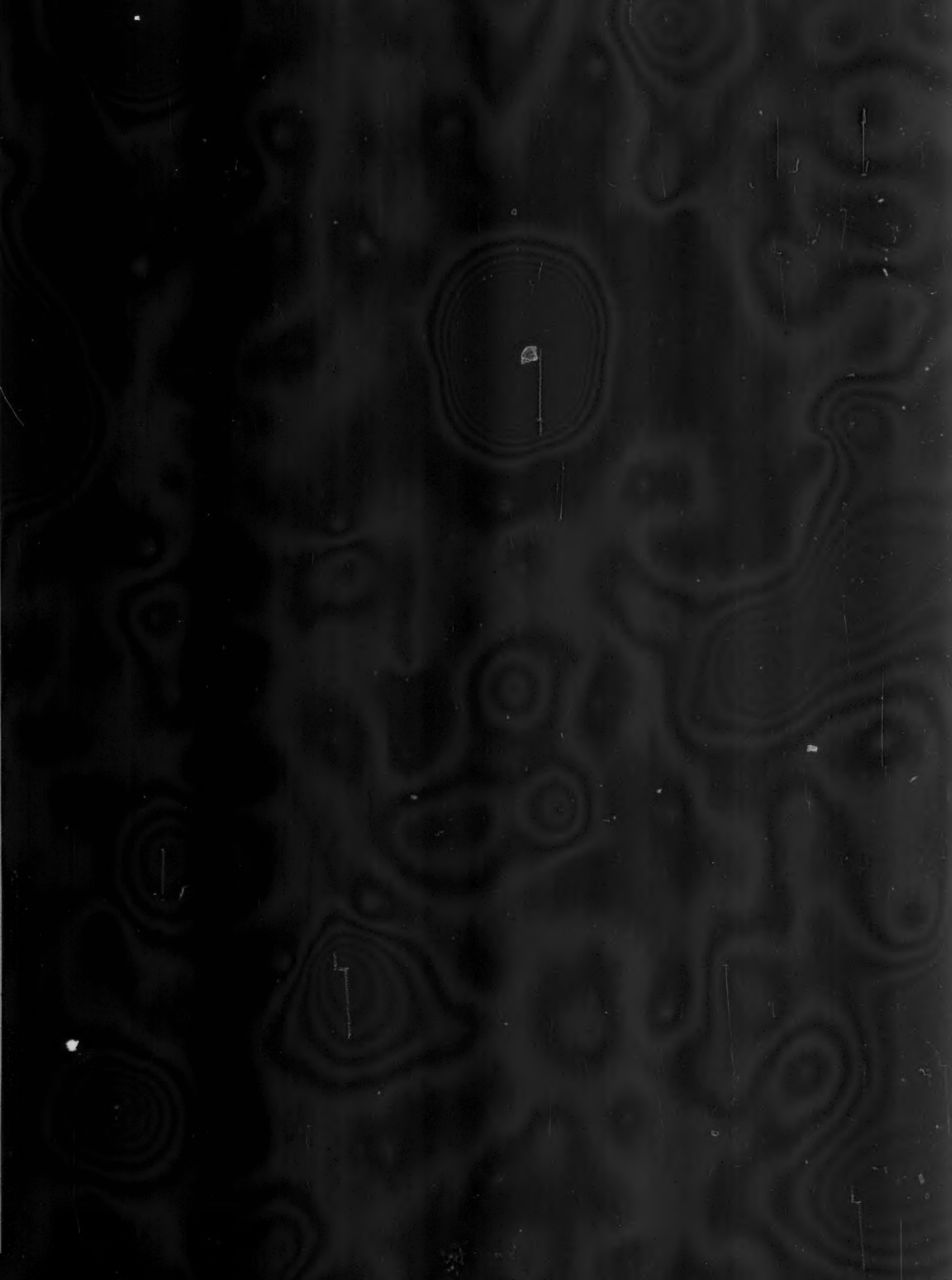
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